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VOL. XVIII, NO. 1 WASHINGTON JANUARY, 1907

THE NATIONAL GEOGRAPHIC MAGAZINE

AËRIAL LOCOMOTION

With a Few Notes of Progress in the Construction of an Aërodrome*

BY ALEXANDER GRAHAM BELL

FORMERLY PRESIDENT OF THE NATIONAL GEOGRAPHIC SOCIETY

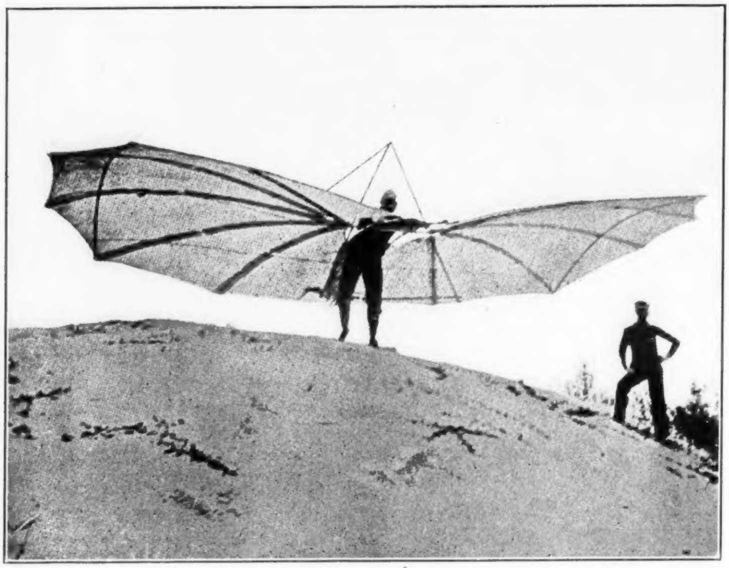
THE history of aërial locomotion is full of tragedies, and this is specially true where flying-machines are concerned. Men have gone up in balloons, and most of them have come down safely. Men have launched themselves into the air on wings, and most have met with disaster to life or limb. There have been centuries of effort to produce a machine that should fly like a bird, and carry a man whithersoever he willed through the air; and previously to 1783, the year sacred to the memory of the brothers Montgolfier, all experiments at aërial locomotion had this end exclusively in view.

Then came a period when the conquest of the air was sought through the agency of balloons. For more than one hundred years the efforts of experimenters were chiefly directed to the problem of rendering the balloon dirigible; and the earlier experiments with gliding machines, and artificial wings, and the projects of men to drive heavy bodies through the air by means of propellers were largely forgotten. The balloon was changed from its original spherical form to a shape better adapted for propulsion; and at last, through the efforts of Santos Dumont, we have arrived at the dirigible balloon of today. But in spite of the dirigibility of the modern balloon, it has so far been found impracticable to impart to this frail structure a velocity sufficient to enable it to make headway against anything but the mildest sort of wind. The character of the balloon problem has therefore changed. Velocity of propulsion rather than dirigibility is now the chief object of research.

THE BIRDS ARE ONCE MORE RECOGNIZED AS THE TRUE MODELS OF FLIGHT

It has long been recognized by a growing school of thinkers that an aërial vehicle, in order to cope with the wind, should be specifically heavier than the air through which it moves. This position is supported by the fact that all of Na-

*An address read before the Washington Academy of Sciences, December 13, 1906, and specially revised by Dr Bell for publication in the NATIONAL GEOGRAPHIC MAGAZINE.



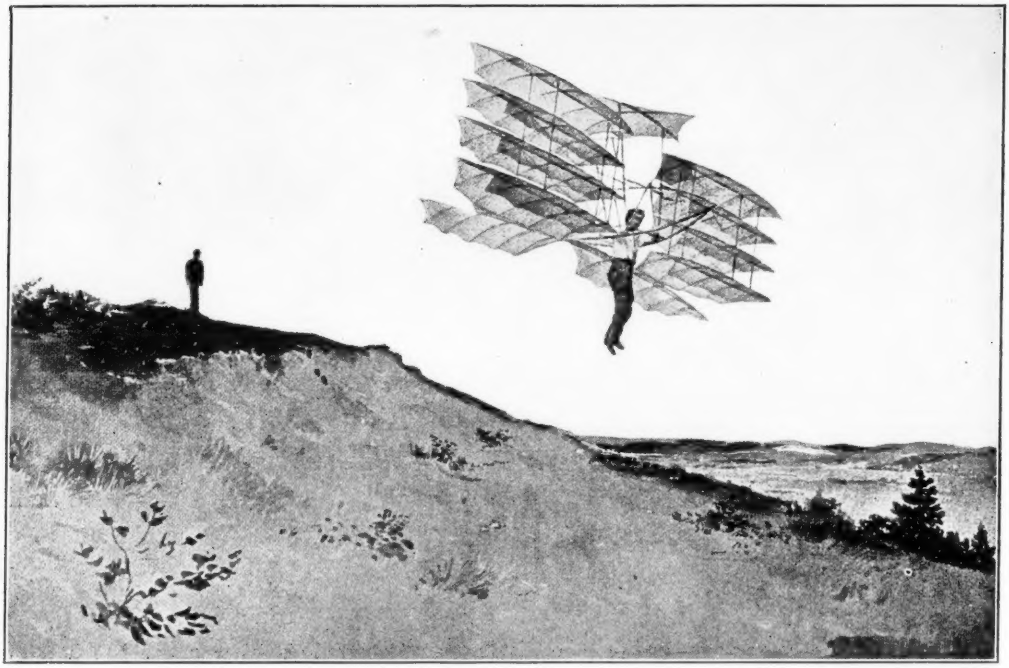
Lilienthal Gliding Machine as Reproduced in America for Chanute by Herring

However this may be, it is certainly the case that the tendency of aërial research is today reverting more and more to the old lines of investigation that were pursued for hundreds of years before the invention of the balloon diverted attention from the subject. The old devices have been reinvented; the old experiments have been tried once more. Again, the birds are recognized as the true models of flight, and again men have put on wings, but this time with more promise of success.

ture's flying models, from the smallest insect to the largest bird, are specifically heavier than the air in which they fly, most of them many hundreds of times heavier, and that none of them adopt the balloon principle in flight. It is also significant in this connection that some of Santos Dumont's most celebrated exploits were accomplished with quite a small balloon, so ballasted as to sink in the air instead of rise. He was then enabled, under the influence of his motive power, to steer his balloon upward without the expenditure of ballast and to descend without the loss of gas. This probably typifies, for the balloon, the direction of change in the future. A reduction in the volume of gas coincidently with an increase in motive power will lead to greater velocity of propulsion, now the main desideratum. Then dependence upon velocity for support rather than gas may gradually lead to the elimination of the gas bag altogether; in which case the balloon will give birth to a flying machine of the heavier-than-air type.

THE GLIDING FLIGHTS OF LILIENTHAL

Lilienthal boldly launched himself into the air in an apparatus of his own construction, having wings like a bird and a tail for a rudder. Without any motor, he ran down hill against the wind. Then, upon jumping into the air, he found himself supported by his apparatus, and glided down hill at an elevation of a few feet from the ground, landing safely at a considerable distance from his point of departure. This exhibition of gliding flight fairly startled the world, and henceforth the experiments of Lilienthal were conducted in the public eye. He made hundreds of successful flights with his gliding machine, varying its construction from time to time, and communicating to the world the results of his experiments with practical directions how to manage the machine under circumstances of difficulty; so that, when at last he met with the usual fate of his predecessors in this line, the experiments were not abandoned. They were continued in America by



Gliding Through the Air on Chanute's Multiple-winged Glider

Chanute of Chicago, Herring, and other Americans, including the Wright brothers, of Dayton, Ohio.

Hargrave of Australia attacked the flying-machine problem from the standpoint of a kite, communicating his results to the Royal Society of New South Wales. It is to him we owe the modern form of kite known as the "Hargrave box kite," which surpasses in stability all previous forms of kites. He also constructed successful flying-machine models on a small scale, using a store of compressed air as his motive power. He did not attempt to construct a large-sized apparatus or to go up into the air himself; so he still lives, to carry on researches that are of interest and value to the world.

SUCCESSFUL FLIGHT OF PROFESSOR LANGLEY'S MODEL

No one has contributed more to the modern revival of interest in flying-machines of the heavier-than-air type than our own Professor Langley, the late Secretary of the Smithsonian Institution. The constant failures and disasters of the past had brought into disrepute the whole subject of aërial flight by man; and the would-be inventor or experimenter had to face not only the natural difficulties of his subject, but the ridicule of a skeptical world. To Professor Langley is due the chief credit of placing this subject upon a scientific basis, and of practically originating what he termed the art of "aërodromics." In his epoch-making work on "Experiments in Aërodynamics," published in 1891 among the Smithsonian Contributions to Knowledge, he prepared the world for the recent advances in this art by announcing that—

"The mechanical sustention of heavy bodies in the air, combined with very great speeds, is not only possible, but within reach of mechanical means we actually possess."

He also attempted to reduce his principles to practice by the construction of a

Langley's Aërodrome No. 5 in Flight, May 6, 1896

From instantaneous photograph by Alexander Graham Bell

large model of an aërodrome driven through the air by a steam-engine under the action of its own propellers. I was myself a witness of the memorable experiments made by Professor Langley on the 6th of May, 1896, with this large-sized model, which had a spread of wing of about 14 feet. No one who witnessed the extraordinary spectacle of a steam-engine flying with wings in the air, like a great soaring bird, could doubt for one moment the practicability of mechanical flight. I was fortunate in securing a photograph of this machine in full flight in the air, so that an automatic record of the achievement exists (page 4). The experiment realized the utmost hopes and wishes of Professor Langley at that time:

> "I have brought to a close," he says, "the portion of the work which seemed to be specially mine—the demonstration of the practicability of mechanical flight; and for the next stage, which is the commercial and practical development of the idea, it is probable that the world may look to others. The world indeed will be supine if it does not realize that a new possibility has come to it, and that the great universal highway over head is now soon to be opened."

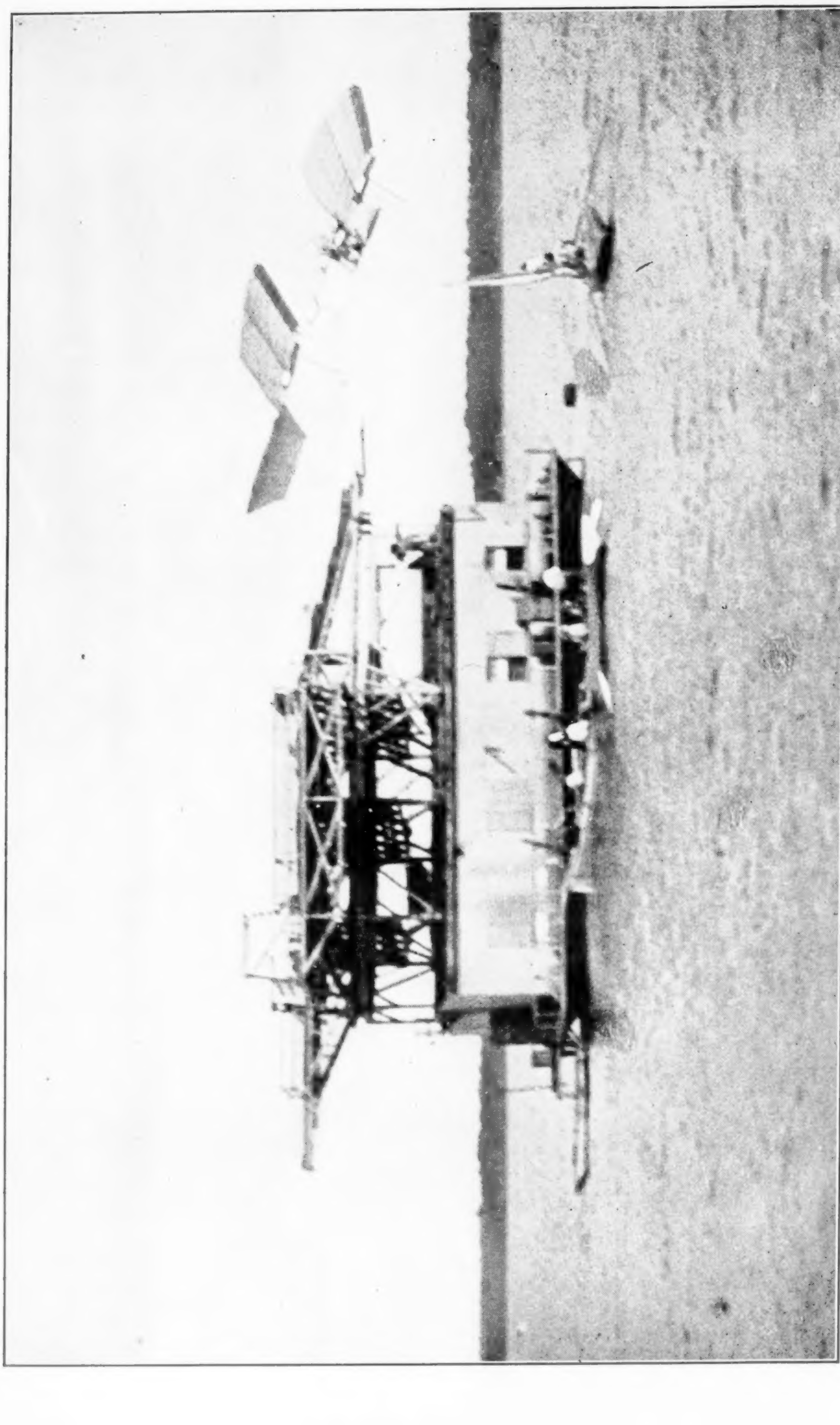
But the world was not satisfied with this position. It looked to Professor Langley himself to carry on the experiments to the point of actually transporting a human being through the air on an aërodrome like his model, and so, with the aid of an appropriation from the War Department of the United States, Professor Langley actually constructed a full-sized aërodrome, and found a man brave enough to risk his life in the apparatus—Mr Manley, of Washington, D. C.

LANGLEY'S EXPERIMENTS WITH HIS LARGE MACHINE

Great public interest was aroused; but Professor Langley did not feel justified in giving information to the public, and therefore to foreign nations, concerning experiments undertaken in the interests of the War Department. His own dislike to premature publicity coöperated with his conscientious scruples to lead him to deny the newspapers the opportunity of witnessing the experiments. But the newspapers insisted upon being represented. The correspondents flocked to the scene, and camped there for weeks, at considerable expense to their papers. They watched the house-boat containing the aërodrome by day and by night, and upon the least indication of activity within, newspaper reporters were on hand in boats. After long delay in hopes of securing privacy it was at last decided to try the apparatus; but the newspaper representatives, embittered by the attempts to exclude them, were bringing the experiments into public contempt. They nicknamed the apparatus "The Buzzard," and were all ready to presage defeat.

Two experiments were made; but on both occasions the apparatus caught in the launching ways and was precipitated into the water without having a chance to show what it could do in the air. The newspapers immediately announced to the world the failure of Professor Langley's machine and ridiculed his efforts. The fact of the matter is that the machine was never tried, and that there was no more reason for declaring it a failure than for deciding that a ship would not float that has never been launched. After having witnessed the successful flights of the large-sized model of 1896, I have no doubt that Professor Langley's full-sized aërodrome would have flown had it been safely launched into the air.

When the machine was for the second time precipitated into the water it was not much damaged by the accident. Professor Langley, of course, was more anxious about the fate of his intrepid assistant than of his machine, and followed Mr Manley into the house-boat to ascertain his condition. During this temporary withdrawal from the scene of the catastrophe the crew of a tugboat grappled the frail framework of the submerged aërodrome, and in the absence of any one competent to direct their efforts they broke the machine to pieces, thus ending the possibility of further experiments without the expenditure of much



The Accident to Langley's Aërodrome

From an instantaneous photograph loaned by the Smithsonian Institution. The machine caught in the launching ways and was injured, being precipitated into the water without having a chance to show what it could do in the air

capital. The ridicule of the newspapers, however, effectually prevented Professor Langley from securing further financial aid, and, indeed, broke his heart. There can be little doubt that the unjust treatment to which he was exposed contributed materially to the production of the illness that caused his death.

He lived long enough, however, to know of the complete fruition of his hopes by others, and only two days before his death he had the gratification of receiving a communication from the newly formed Aëro Club of America recognizing and appreciating his efforts to promote mechanical flight. This communication read as follows:

RESOLUTIONS OF THE AERO CLUB OF AMERICA, ADOPTED JANUARY 20, 1906

"WHEREAS our esteemed colleague, Dr S. P. Langley, Secretary of the Smithsonian Institution, met with an accident in launching his aërodrome, thereby missing a decisive test of the capabilities of this man-carrying machine, built after his models which flew successfully many times; and

"WHEREAS, in that difficult experiment, he was entitled to fair judgment and distinguished consideration because of his important achievements in investigating the laws of dynamic flight, and in the construction of a variety of successful flying models: Therefore be it

"*Resolved*, That the Aëro Club of America, holding in high estimation the contributions of Dr Langley to the science of aërial locomotion, hereby expresses to him its sincerest appreciation of his labors as a pioneer in this important and complex science; and be it further

"*Resolved*, That a copy of these resolutions be sent to the Board of Regents of the Smithsonian Institution, and to Doctor Langley."

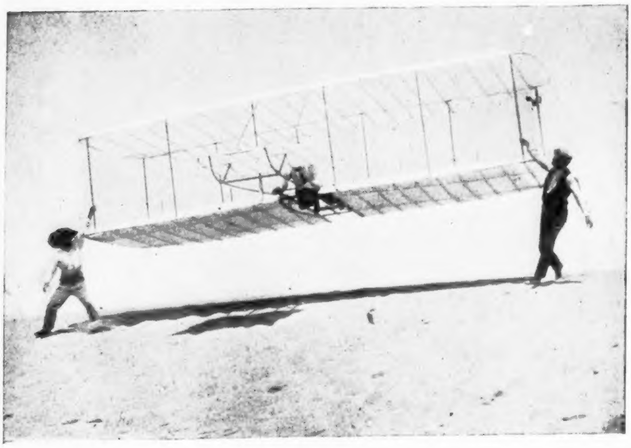
Professor Langley was on his deathbed when these resolutions were brought to his attention, and when asked what should be done with the communication his pathetic answer was, "*Publish it.*" To all who know his extreme aversion to publicity in any form this reply indicates how keenly he felt the misrepresentations of the press.

THE FIRST PRACTICAL FLYING-MACHINE

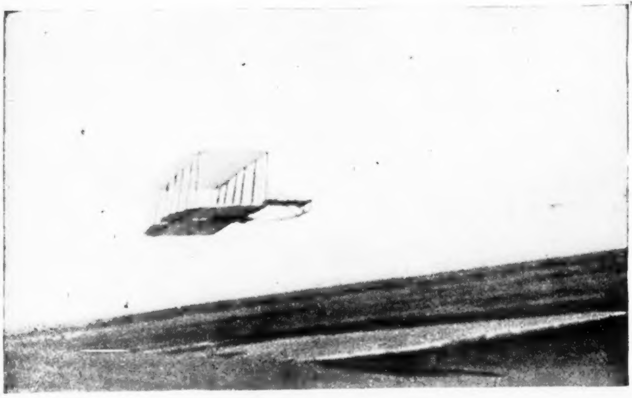
Both in the case of Lilienthal and Langley their efforts have not been in vain. Others have continued their researches, and today the world is in possession of the first practical flying-machine, the creation of the brothers Orville and Wilbur Wright, of Dayton, Ohio. Indeed, we have news from France that a second has just appeared, constructed by the same Santos Dumont to whom the world already owes the first practical dirigible balloon.

The Wright brothers began by repeating the gliding experiments of Lilienthal, with improved apparatus of the Hargrave type as modified by Chanute. After having made many successful glides through the air without a motor, they followed in the footsteps of Langley and propelled their machine by means of twin screws operated by engine power. They were successful in launching their apparatus into the air, and it flew, carrying one of them with it. Their machine has flown not once simply, but many times, and in the presence of witnesses; so that there can be no doubt that the first successful flying-machine has at last appeared. Specially successful flights were made on the 3d and 4th of October, 1905, which were referred to by the Wright brothers in a letter to the editor of *L'Aerophile* published in that journal January, 1906. They have also made a communication upon the subject to the Aëro Club of America, and have received the formal congratulations of that organization upon their success.

Each of the Wright brothers in turn has made numerous flights over their testing field near Dayton, Ohio, sometimes at an elevation of about 80 feet; at other times skimming over the field at a height of about ten feet from the ground. They have been able to circle over the field of operation, and even to describe in the air the figure eight, thus demonstrating their perfect control over their apparatus, both in the vertical and horizontal directions. They have succeeded in remaining continuously in the air for more than half an hour—thirty-eight minutes, in fact—and only came



Starting a Flight



A High Glide

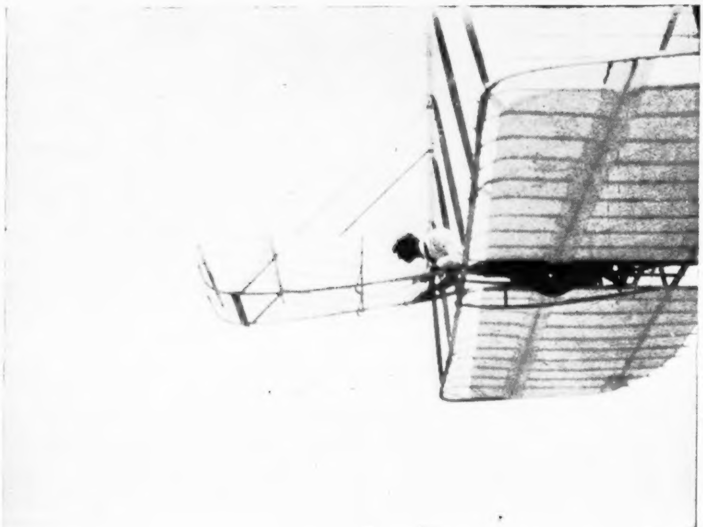
The Wright Brothers' Gliding Machine

down on account of the exhaustion of their fuel supply. They state that the velocity attained was one kilometer per minute, or about thirty-seven miles an hour. The machine has not only sustained its own weight in the air during these trials, but has also carried a man and a gasoline engine weighing 240 pounds, exerting a force of from 12 to 15 horse-power, and in addition an extra load of 50 pounds of pig-iron. The apparatus complete, with motor, weighed no less than 925 pounds, while the supporting surfaces consisted of two superposed aëroplanes each measuring six by forty feet; so that the machine as a whole had a flying weight of nearly two pounds per square foot (1.9 pounds).

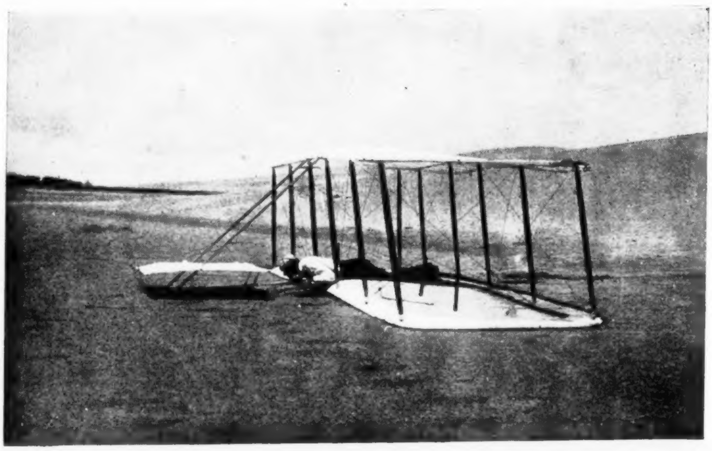
Thanks to the efforts of the Wright brothers, the practicability of aërial flight by man is no longer problematical. We can no longer consider as impossible that which has already been accomplished. America may well feel proud of the fact that the problem has been first solved by citizens of the United States.

A FEW NOTES OF PROGRESS IN THE CONSTRUCTION OF AN AERODROME

For many years past—in fact, from my boyhood—the subject of aërial flight has had a great fascination for me. Before the year 1896 I had made many thousands of still unpublished experiments having a bearing upon the subject, and I was therefore much interested in the researches of Professor Langley relating to aërodynamics. We were thrown closely together in Washington, and although we rarely conversed upon aërodynamics we knew that we had a subject of mutual interest and showed the greatest personal confidence in one another. I did not hesitate to show him my experiments; he did not hesitate to show me his. At least as early as 1894 Professor Langley visited me in my Nova Scotia home and witnessed some of my experiments; and in May, 1896, he reciprocated by inviting me to accompany him to Quantico, Virginia, and witness a trial of his large-sized model. The sight of



Soaring



Landing

Langley's steam aërodrome circling in the sky convinced me that the age of the flying-machine was at hand. Encouraged and stimulated by this remarkable exhibition of success, I quietly continued my experiments in my Nova Scotia laboratory in the hope that I, too, might be able to contribute something of value to the world's knowledge of this important subject.

Warned by the experiences of others, I have sought for a safe method of approach—a method that should risk human life as little as possible during the earlier stages of experiment. Experiments with aërodromes must necessarily be fraught with danger until man, by practical experience of the conditions to be met with in the air and of the means of overcoming them, shall have attained skill in the control of aërial apparatus. A man cannot even ride a bicycle without practice, and the birds themselves have to learn to fly. Man, not having any inherited instincts to help him in this matter, must first control his flight consciously, guided by knowledge gained through experiment. Skill can only be obtained by actual experience in the air, and this experience will involve accidents and disasters of various sorts before skill can be obtained. If these disasters should, as so often in the past, prove fatal to the experimenter, the knowledge obtained by the would-be aviator will be lost to the world, and others must begin all over again, instead of pursuing the subject where he left off, with the benefit of his knowledge and his experience. It is therefore of the utmost consequence to

progress in the art of aviation that the first attempts to gain experience in the air should be made under such conditions of safety as to reduce to a minimum the liability to fatal results.

A MACHINE THAT WILL SUPPORT ITSELF AT LOW VELOCITY DESIRABLE

The Wright brothers' successful flying-machine travels at the rate of about thirty-seven miles an hour; and, judging from its great flying weight (nearly two pounds per square foot of supporting surface), it is unlikely that it could be maintained in the air if it had a very much less velocity. But should an accident happen to a body propelled through the air with the velocity of a railroad train, how about the safety of the occupants? Accidents will happen, sooner or later, and the chances are largely in favor of the first accident being the last experiment. While, therefore, we may look forward with confidence to the ultimate possession of flying-machines exceeding in speed the fastest railroad trains, it might be the part of wisdom to begin our first experiments at gaining experience in the air with machines traveling at such moderate velocities as to reduce the chances of a fatal catastrophe to a minimum. This means that they should be light-flying machines—that is, the ratio of weight to supporting surface should be small.

While theory indicates that the greater the weight in proportion to supporting surface consistent with flight, the more independent of the wind will the machine be, yet it might be advisable to begin, if possible, with such a moderate flying weight as to permit of the machine being flown as a kite. There would be little difficulty, then, in raising it into the air, and should an accident happen to the propelling machinery, the apparatus would descend gently to the ground; or the aviator could cast anchor, and his machine would continue flying, as a kite, if the wind should prove sufficient for its support. If it could fly, as a kite, in a ten-mile breeze, then a velocity of only ten miles an hour would be sufficient for its support as a flying-machine in calm air, while a less speed would suffice in heading into a moderate wind.

Such velocities would be consistent with safety in experiments, especially if the flights should be made over water instead of land, and at moderate elevations above the surface. Under such circumstances the inevitable accidents which are sure to happen during first experiments are hardly likely to be followed by more serious consequences than a ducking to the man and the immersion of the machine. If the man is able to swim and the machine to float upon water, little damage need be anticipated to either.

There are two critical points in every aërial flight—its beginning and its end. A flying-machine adapted to float upon water not only seems to afford a safe means of landing, but also promises a solution of that most difficult of problems—a safe method of launching the apparatus into the air. If the supporting floats are so formed as to permit of the machine being propelled over the surface of the water like a motor boat, then, if sufficient headway can be gained under the action of her aërial propellers, the machine can be steered upward into the air, rising from the water, after the manner of a water bird, in the face of the wind. This seems to be the safest method of gaining access to the air; but, of course, its practicability depends upon possibilities of lightness and speed yet to be demonstrated.

In any event, if the machine, man and all, is light enough to be flown as a kite, it can be towed out of the water into the air through the agency of a motor boat; and, upon land, it would not even be necessary for it to gain headway before rising, for in a supporting wind it would rise of itself into the air, if relieved of the weight of the man, and fly as a kite. It would then be a comparatively simple matter to lower the kite to a convenient height from the ground, and to hold it steadily in position by subsidiary lines

while the aviator ascends a rope ladder to his seat in the machine. In this way the man would not be exposed to danger during the critical operation of launching the apparatus into the air, and by a converse process a safe landing could be effected without bringing the machine to the ground. The chance of injury to the machine itself would also be much lessened by relieving it of the weight of the man during the initial process of launching and the final process of bringing the machine down to the ground.

Such speculations as these of course are only justifiable upon the assumption that it is possible to construct an aërial vehicle large enough and strong enough to support a man and an engine in the air, and yet light enough to be flown as a kite in a moderate breeze with the man and engine and all on board. My experiments in Nova Scotia have demonstrated that this can be done; and I now therefore find myself seriously engaged in the attempt to reduce these ideas to practice by the actual construction of an aërodrome of the kite variety. The progress of experiment may be divided into three well-marked stages: the kite stage, the motor-boat stage, and the free flying-machine rising from the water.

THE KITE STAGE

In April, 1899, I made my first communication on the subject of kites to the National Academy of Sciences in a paper entitled "Kites with Radial Wings," which was reviewed, with illustrations, in the *Monthly Weather Review* for April, 1899 (vol. xxvi, pp. 154-155, plate XI). I made another communication to the National Academy on the 23d of April, 1903, upon "The Tetrahedral Principle in Kite Structure," which was published, with ninety-one illustrations and an appendix, in the NATIONAL GEOGRAPHIC MAGAZINE for June, 1903 (vol. XIV, pp. 220-251). The substance of the present address was presented in part to the National Academy of Sciences at their recent meeting in Boston, Massachusetts, November 21, 1906. The experiments referred to, which were undertaken at first for my own pleasure and amusement, have gradually assumed a serious character, from their bearing upon the flying-machine problem.

The word "kite" unfortunately is suggestive to most minds of a toy—just as the telephone at first was thought to be a toy; so that the word does not at all adequately express the nature of the enormous flying structures employed in some of my experiments. These structures were really aërial vehicles rather than kites, for they were capable of lifting men and heavy weights into the air. They were flown after the manner of kites, but their flying cords were stout manila ropes. They could not be held by hand in a heavy breeze, but had to be anchored to the ground by several turns of the ropes around stout cleats, like those employed on steamships and men-of-war.

One of the great difficulties in making a large structure light enough to be flown as a kite has been pointed out by Professor Simon Newcomb in an article in *McClure's Magazine*, published in September, 1901, entitled "Is the Air-Ship Coming?" and this difficulty had so much weight with him at that time as to lead him to the general conclusion that—

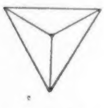
> "The construction of an aërial vehicle which could carry even a single man from place to place at pleasure requires the discovery of some new metal or some new force."

This conclusion the Wright brothers, and now Santos Dumont, have demonstrated to be incorrect; but Professor Newcomb's objections undoubtedly have great force, and reveal the cause of failures of attempts to construct large-sized flying-machines upon the basis of smaller models that actually flew. Professor Newcomb shows that where two aërial vehicles are made exactly alike, only differing in the scale of their dimensions, the ratio of weight to supporting surface is greater in the larger one than in the smaller, the weight increasing as the cube of the dimensions, whereas the supporting surfaces only increase as the squares. From this the conclusion is

obvious that if we make our structure large enough it will be too heavy to fly—even by itself—far less be the means of supporting an additional load like a man and an engine for motive power. This conclusion is undoubtedly correct in the case of structures that are "exactly alike excepting in their dimensions," but it is not true as a general proposition.

EVADING AN OLD LAW

A small bird could not sustain a heavy load in the air; and while it is true that a similar bird of double the dimensions would be able to carry a less proportionate weight, because it is itself heavier in proportion to its wing surface than the smaller bird—eight times as heavy, in fact, with only four times the wing surface—still it is conceivable that a flock of small birds could sustain a heavy load divided equally among them; and it is obvious that in this case the ratio of weight to wing surface would be the same for the whole flock as for the individual bird. If, then, we build our large structure by combining together a number of small structures each light enough to fly, instead of simply copying the small structure upon a larger scale, we arrive at a compound or cellular structure in which the ratio of weight to supporting surface is the same as that of the individual units of which it is composed, thus overcoming entirely the really valid objections of Professor Newcomb to the construction of large flying-machines.



Unit cell having the form of the regular tetrahedron

In my paper upon the tetrahedral principle in kite structure I have shown that a framework having the form of a tetrahedron possesses in a remarkable degree the properties of strength and lightness. This is specially the case when we adopt as our unit structure the form of the regular tetrahedron, in which the skeleton frame is composed of six rods of equal length, as this form seems to give the maximum of strength with the minimum of material. When these tetrahedral frames or cells are connected together by their corners they compose a structure of remarkable rigidity, even when made of light and fragile material, the whole structure possessing the same properties of strength and lightness inherent in the individual cells themselves (page 12).

The unit tetrahedral cell yields the skeleton form of a solid, and it is bounded by four equal triangular faces. By covering two adjoining faces with silk, or other material suitable for use in kites, we arrive at the unit "winged cell" of the compound kite, the two triangular surfaces in their flying position resembling a pair of wings raised with their points upward, the surfaces forming a dihedral angle (Fig. A, p. 13).

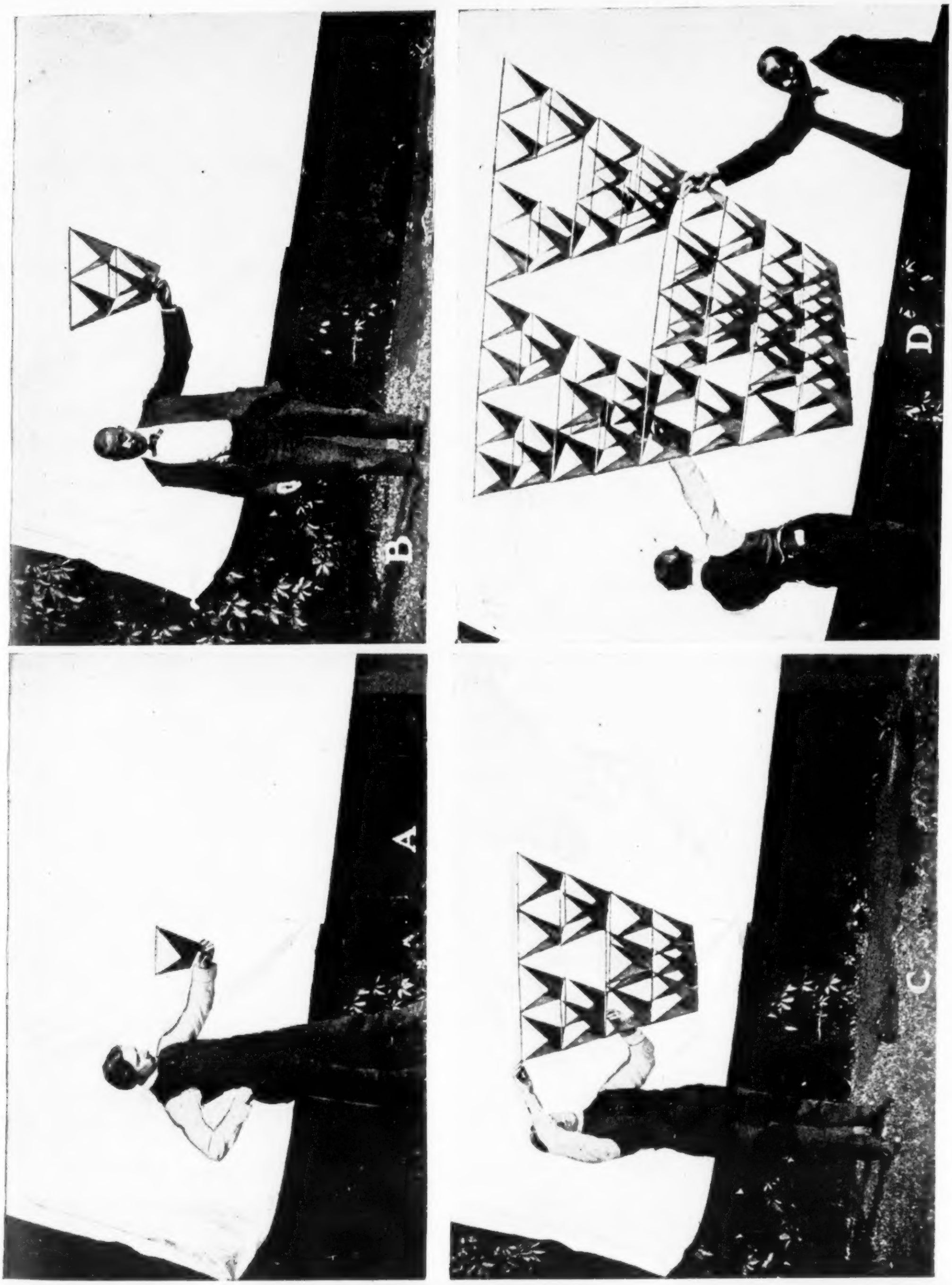
Four of these unit cells, connected together at their corners, form a four-celled structure having itself the form of a tetrahedron containing in the middle an empty space of octahedral form equal in volume to the four tetrahedral cells themselves (Fig. B, p. 13).

In my paper I showed that four of these four-celled structures connected at their corners resulted in a sixteen-celled structure of tetrahedral form containing, in addition to the octahedral spaces between the unit cells, a large central space equivalent in volume to four of the four-celled structures (Fig. C, p. 13).

In a similar manner four of the sixteen-celled structures connected together at their corners form a sixty-four-celled structure (Fig. D, p. 13).

Four of the sixty-four-celled structures form a two hundred and fifty-six-celled structure, etc., and in each of these cases an empty space exists in the center equivalent to half of the cubical contents of the whole structure, in addition to spaces between the individual cells and minor groups of cells.

Kites so formed exhibit remarkable stability in the air under varying conditions of wind, and I stated in my paper that the kites which had the largest central spaces seemed to be the most stable in the air. Of course, these were the



A. Single-winged cell. B. Four-celled kite. C. Sixteen-celled kite. D. Sixty-four-celled kite

On this, the hollow plan of construction, an empty space appears in the middle of each kite, B, C, or D, equivalent in volume to one-half of the cubical contents of the whole structure

64-celled Tetrahedral Kite Flying from Flag-pole

Photograph by D. G. McCurdy

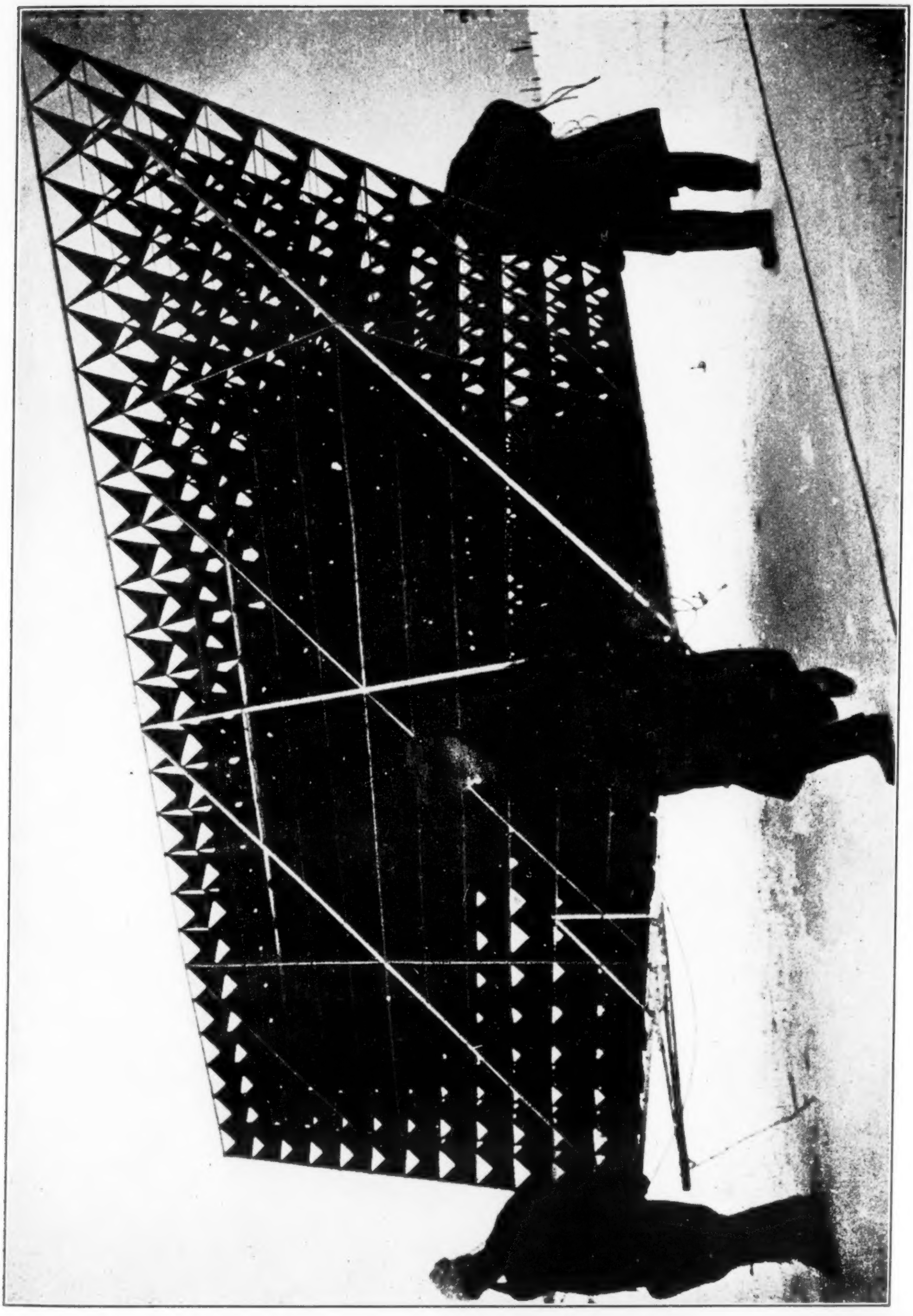
structures that were composed of the largest number of unit cells, and I now have reason to believe that the automatic stability of these kites depends more upon the number of unit cells than upon the presence of large empty spaces in the kites; for I have found, upon filling in these empty spaces with unit cells, that the flying qualities of a large kite have been greatly improved. The structure, so modified, seems to fly in as light a breeze as before, but with greatly increased lifting power, while the gain in structural strength is enormous.

I had hitherto supposed that if cells were placed directly behind one another without providing large spaces between them comparable to the space between the two cells of a Hargrave box kite, the front cells would shield the others from the action of the wind, and thus cause them to lose their efficiency; but no very marked effect of this kind has been observed in practice. Whatever theoretical interferences there may be, the detrimental effect upon the flying qualities of a kite are not, practically, obvious, while the gain in structural strength and in lifting power outweigh any disadvantages that may exist. I presume that there must be some limit to the number of cells that can be placed in close proximity to one another without detrimental effect, but so far my experiments have not revealed it.

EXPERIMENTS WITH "THE FROST KING"

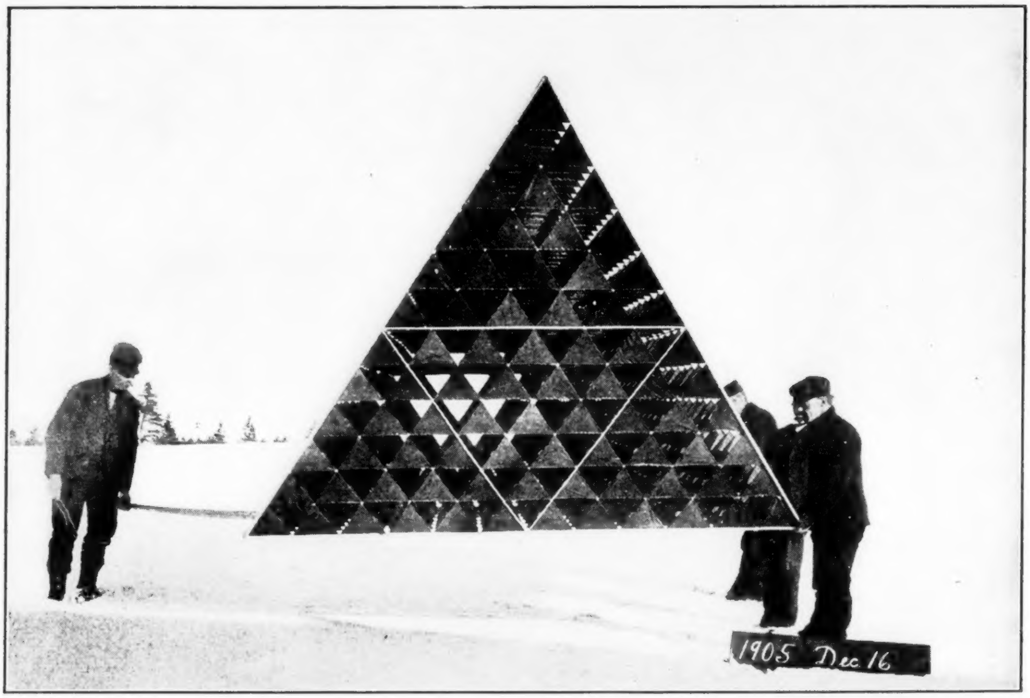
To test the matter, I put together into one structure all the available winged cells I had in the laboratory—1,300 in number. These were closely attached together, without any other empty spaces in the structure than those existing between the individual cells themselves when in contact at their corners.

The resulting kite, known as "The Frost King" (pages 15 and 16), consisted of successive layers or strata of cells closely superposed upon one another. The lowest layer, or floor of the structure, consisted of 12 rows of 13 cells each. The cells forming each row were placed side by side, attached to one another by their upper corners, and the 12 rows were placed one behind the other, the rear corners of one row being attached to the front corners of the row immediately behind. The next stratum above the floor had 11 rows of 14 cells; the next, 10 rows of 15 cells, etc., each successive layer increasing in lateral dimensions and diminishing in the fore-and-aft direction; so that the top layer, or roof, consisted of a single row of 24 cells placed side by side. One would imagine that a closely packed mass of cells of this kind, 1,300 in number, would have developed some difficulty in flying in a moderate breeze, if the cells interfered with one another to any material extent; but this kite not only flew well in a breeze



Carrying the Frost King on to the Testing Ground

This kite was composed of 1,300 light winged cells closely massed together. Photograph by E. H. Cunningham



Side View of the Frost King, showing how closely the cells are massed together
Photograph by E. H. Cunningham

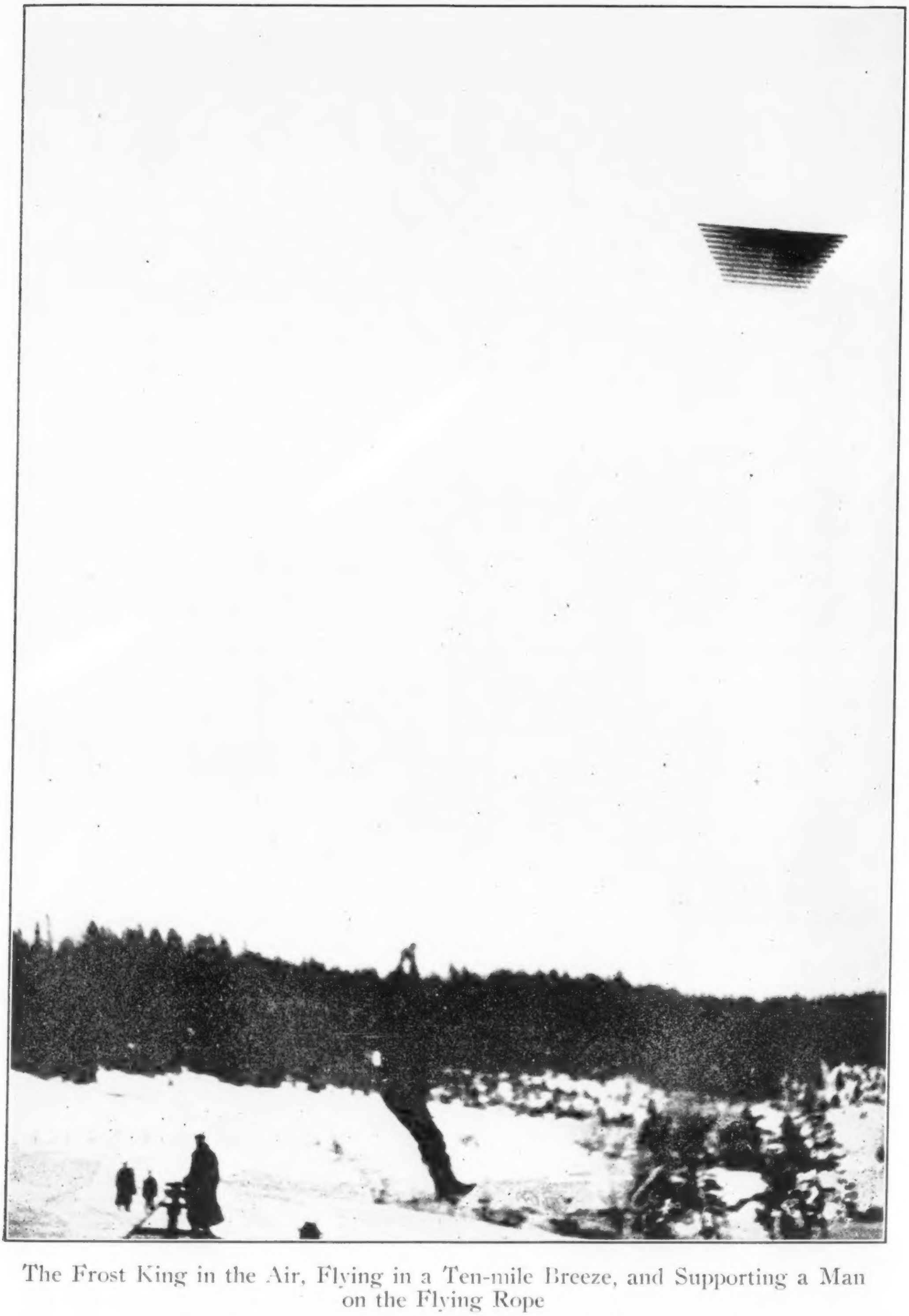
estimated at not more than about 10 miles an hour because it did not raise white caps, but carried up a rope ladder, several dangling ropes 10 and 12 meters long, and more than 200 meters of manilla rope used as flying lines, and, in addition to all this, supported a man in the air (page 17).

The whole kite, impedimenta and all, including the man, weighed about 131 kgs. (288 pounds), and its greatest length from side to side was 6 meters at the top and 3 meters at the bottom. The sloping sides measured 3 meters, and the length from fore to aft at the square bottom was 3 meters. It is obvious that this kite might be extended laterally at the top to twice its length without forming an immoderately large structure. It would then be 12 meters on the top (39 feet) and 9 meters on the bottom from side to side, without changing the fore-and-aft dimensions or the height. It would then contain more than double the number of cells, and so should be able to sustain in the air more than double the load; so that such a structure would be quite capable of sustaining both a man and an engine of the weight of a man and yet be able to fly as a kite in a breeze no stronger than that which supported the "Frost King."

An engine of the weight of a man could certainly impart to the structure a velocity of 10 miles an hour, the estimated velocity of the supporting wind, and thus convert the kite into a free flying-machine. The low speed at which I have been aiming for safety's sake is therefore practicable.

HORIZONTAL AEROPLANES FOUND UNSTABLE

In the "Frost King" and other kites composed exclusively of tetrahedral winged cells there are no horizontal sur-



The Frost King in the Air, Flying in a Ten-mile Breeze, and Supporting a Man on the Flying Rope

During the experiment the rope straightened under the pull of the kite, and the man was raised to a height of 30 or 40 feet. He was in great peril, but fortunately was brought down safely. Photograph by Alexander Graham Bell

faces (or rather surfaces substantially horizontal, as in ordinary kites), but the framework is admirably adapted for the support of such surfaces. Horizontal aëroplanes have much greater supporting power than similar surfaces obliquely arranged, and I have made many experiments to combine horizontal surfaces with winged cells with greatly improved results, so far as lifting power is concerned. But there is always an element of instability in a horizontal aëroplane, especially if it is of large size, whereas kites composed exclusively of winged cells are wonderfully steady in the air under varying conditions, though deficient in lifting power; and the kites composed of the largest number of winged cells seem to be the most stable in the air.

In the case of an aëroplane of any kind the center of air pressure rarely coincides with the geometrical center of surface, but is usually nearer the front edge than the middle. It is liable to shift its position, at the most unexpected times, on account of some change in the inclination of the surface or the direction of the wind. The change is usually small in steady winds, but in unsteady winds great and sudden changes often occur.

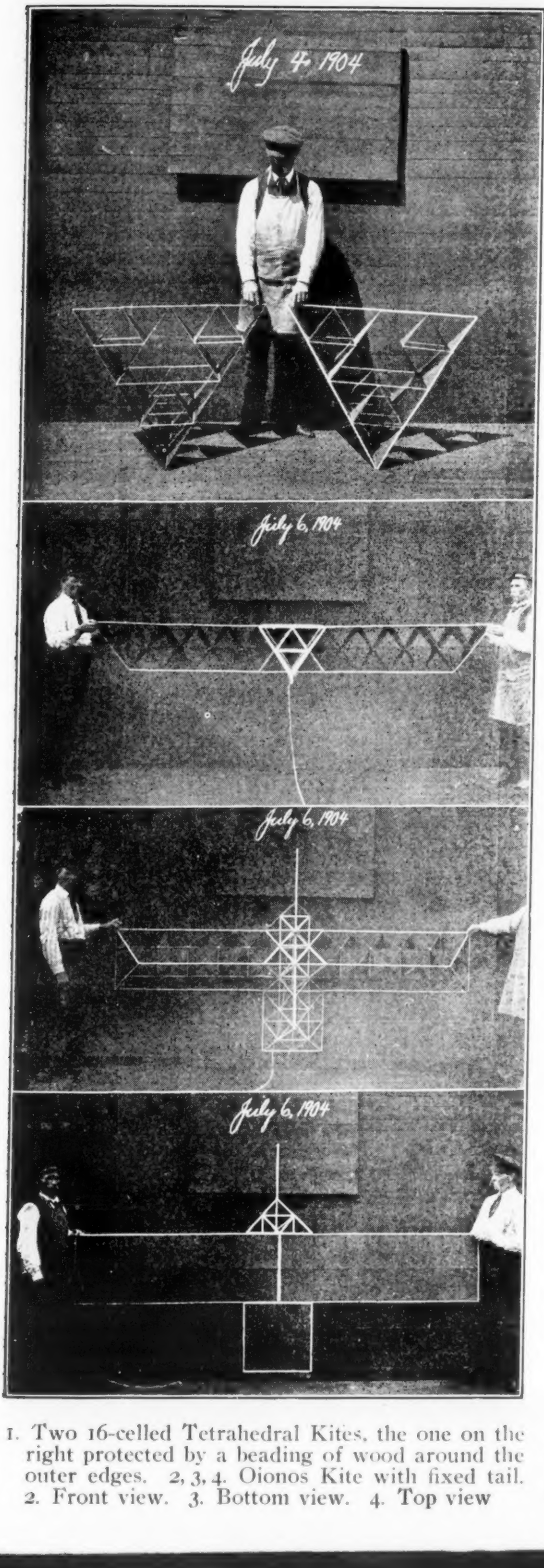
The extreme possible range of fluctuation is of course, from the extreme front of the aëroplane to the rear, or *vice versa*, and the possible amount of change, therefore, depends upon the dimensions of the aëroplane, especially in the fore-and-aft direction. With a large aëroplane the center of pressure may suddenly change to such an extent as to endanger the equilibrium of the whole machine, whereas with smaller aëroplanes, especially those having slight extension in the fore-and-aft direction, the change, though proportionally as great, is small in absolute amount. Where we have a multitude of small surfaces well separated from one another, as in the tetrahedral construction, it is probable that the resultant center of pressure for the whole kite can shift to no greater extent than the centers of pressure of the individual surfaces themselves. It is, therefore, extremely unlikely that the equilibrium of a large kite could be endangered by the shifting of the centers of pressure in small surfaces within the kite. This may be the cause of the automatic stability of large structures built of small tetrahedral cells. If so, one principle of stability would be: *Small surfaces, well separated and many of them.* The converse proposition would then hold true if we desired to produce instability and a tendency to upset in a squall, namely: *Large surfaces, continuous, and few of them.*

HARGRAVE BOX KITES AND TETRAHEDRAL KITES COMPARED

Another source of danger with large continuous surfaces is the fact that a sudden squall may strike the kite on one side, lifting it up at that side and tending to upset it; but the compound tetrahedral structure is so porous that a squall passes right through and lifts the other side as well as the side first struck; so that the kite has not time to be upset before the blow on one side is counterbalanced by a blow on the other. I have flown a Hargrave box kite simultaneously with a large kite of many tetrahedral cells in squally weather for the purpose of comparing them under similar conditions. The tetrahedral structure often seemed to shiver when struck by a sudden squall, whereas the box kite seemed to be liable to a swaying or tipping motion that would be exceedingly dangerous in a structure of large size forming part of a flying-machine.

Another element of stability in the tetrahedral structure lies in the fact that the winged surfaces are elevated at a greater angle above the horizon than 45°.

Supposing the wings of a cell to be opened out until they are nearly flat, or at least until they each make a comparatively small angle with the horizon—say 20°—then, if from any cause the cell should tip so as to elevate one wing (say to 25°) and depress the other (say to 15°), the lifting power of the wind will be increased upon the elevated wing and diminished on the depressed wing;



1. Two 16-celled Tetrahedral Kites, the one on the right protected by a beading of wood around the outer edges. 2, 3, 4. Oionos Kite with fixed tail. 2. Front view. 3. Bottom view. 4. Top view

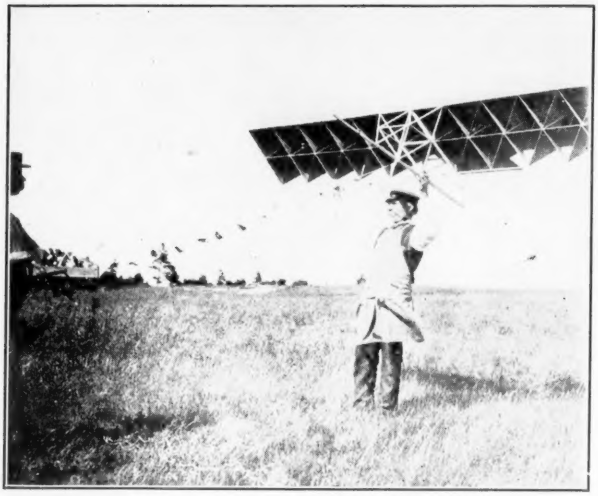
so that there would be no tendency to a recovery of position, but the very reverse. The pressure of the wind would tend to increase the tipping action and favor the production of oscillation and a tendency to upset. The lifting power of the wind upon a surface inclined at 10° is less than at 20°, and greater at 25° than 20°. The more the wings are opened out and the flatter they become, the more essentially unstable is the arrangement in the air.

Now suppose the wings to be raised until they are nearly closed, or at all events till they make a small angle with the vertical (say 70° from the horizontal), then, if from any cause the cell should tip so as to elevate one wing (say to 75°) and depress the other (say to 65°), the lifting power of the wind will be increased upon the depressed wing and diminished on the elevated wing; for the lifting power of the wind is greater at 65° than at 70° and less at 75°. Thus the moment a tipping action begins the pressure of the wind resists it, and an active force is invoked tending to restore the structure to its normal position. The more the wings are raised and the more they approach the perpendicular position, the more stable essentially is the arrangement in the air.

The dividing line beween these two opposite conditions seems to be drawn about the angle of 45°. As the tetrahedral wing surfaces make a greater angle than this with the horizontal, they constitute an essentially stable arrangement in the air, whereas a horizontal surface represents the extreme of the undesirable unstable condition.

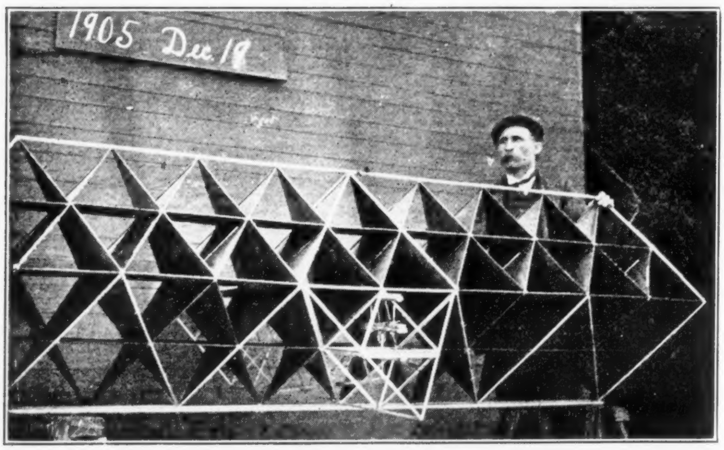
AUTOMATIC STABILITY

These considerations have led me to prefer a structure composed of winged tetrahedral cells alone, without horizontal surfaces either large or small, although the lifting power is less than when horizontal surfaces are employed, because the factor of safety is greater. One of the chief causes that have led to disasters in the past has been a lack of stability in the air. Automatic stability under varying conditions is surely of the very first consequence to safety, for



Method of Flying the Oionos Kite

Pieces of red silk are attached to several meters of the flying cord with the object of rendering the direction of the cord visible on the photograph plate



Oionos Kite with Movable Tail Controlled by Swinging Head-load of Lead

When released in the air at a considerable elevation it acts very much like a soaring bird, moving forward against the wind or swinging around in large circles. It is then, in effect, a free gliding machine, which acquires considerable velocity in the horizontal direction, while descending gently in the vertical direction. The head-load gives the machine a slight tendency to dive, which is resisted by the steering action of the tail when headway is gained. The moment the head is depressed, as in diving, the weight swings forward, thus automatically causing the elevation of the tail

what would it profit a man were he to gain the whole world and lose his own equilibrium in the air? A kite composed exclusively of multitudinous winged cells seems to possess this property of automatic stability in a very marked degree. If, then, its lifting power is sufficient for our purpose, there is no necessity for the introduction of a factor of danger by the addition of horizontal surfaces. Of course, the addition of such surfaces would enable us to secure the desired lifting power with a smaller, and therefore lighter, structure, and this would be of advantage if we could be sure of its stability in the air.

In employing tetrahedral winged cells alone upon the hollow plan of construction in which large empty spaces occurred within the kite, a practical difficulty was encountered arising from the enormous size of the structure required for the support of a man, combined with the increasing weakness of the structure as it increased in size. The discovery that the cells may be closely massed together without marked injurious effects has completely remedied this difficulty; for upon this plan not only is the structural strength improved by an increase of size, but the lifting power increases with the cube of the dimensions; so that a very slight increase in the dimensions of a

large kite increases very greatly its lifting power. We now have the possibility of building structures composed exclusively of tetrahedral winged cells that will support a man and an engine in a breeze of moderate velocity without the necessity of constructing a kite of immoderate size. The experiments with the "Frost King" made in December, 1905, satisfied me upon this point and brought to a close my experiments with kites.

CONCLUSION

Since December, 1905, my attention has been directed to other points necessary to be considered before an aërodrome of the kite variety can be made, and to the assembling of the materials for its manufacture.

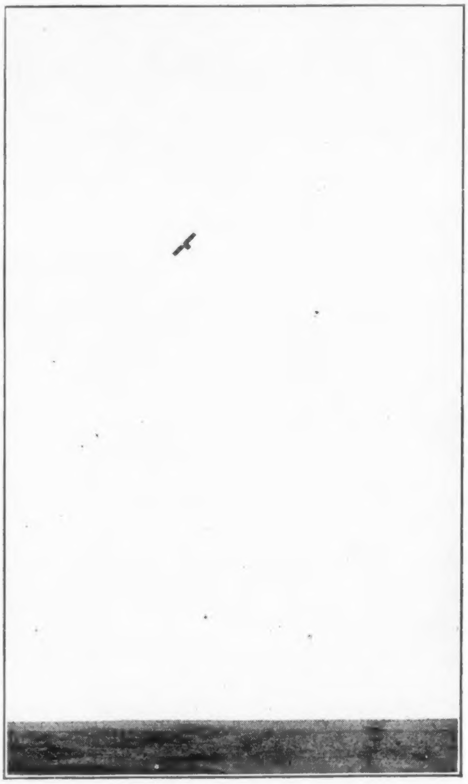
I have had to improve and simplify the method of making the winged cells themselves. Through the agency of Mr Hector P. McNeil, superintendent of the Volta laboratory, Washington, D. C., who is now taking up the manufacture of tetrahedral cells as a new business, I am now able to obtain cells constructed largely by machinery, and with stamped metal corners to hold the rods together. The process of tying the cells and parts of cells together had proved to be very laborious and expensive, and the process was not suited to unskilled persons. By the new process most of the work is done by machinery, and no skill is required to connect the cells together.

I have also had to go into the question of motor construction—a subject with which I am not familiar—and while waiting for the completion of the material required for the aërodrome I have been carrying on experiments to test the relative efficiency of various forms of aërial propellers.

I have also been occupied with the details of construction of a supporting float adapted for propulsion over the water as a motor boat and also adapted to form the body of the flying-machine when in the air.

BOATS DRIVEN BY AERIAL PROPELLERS

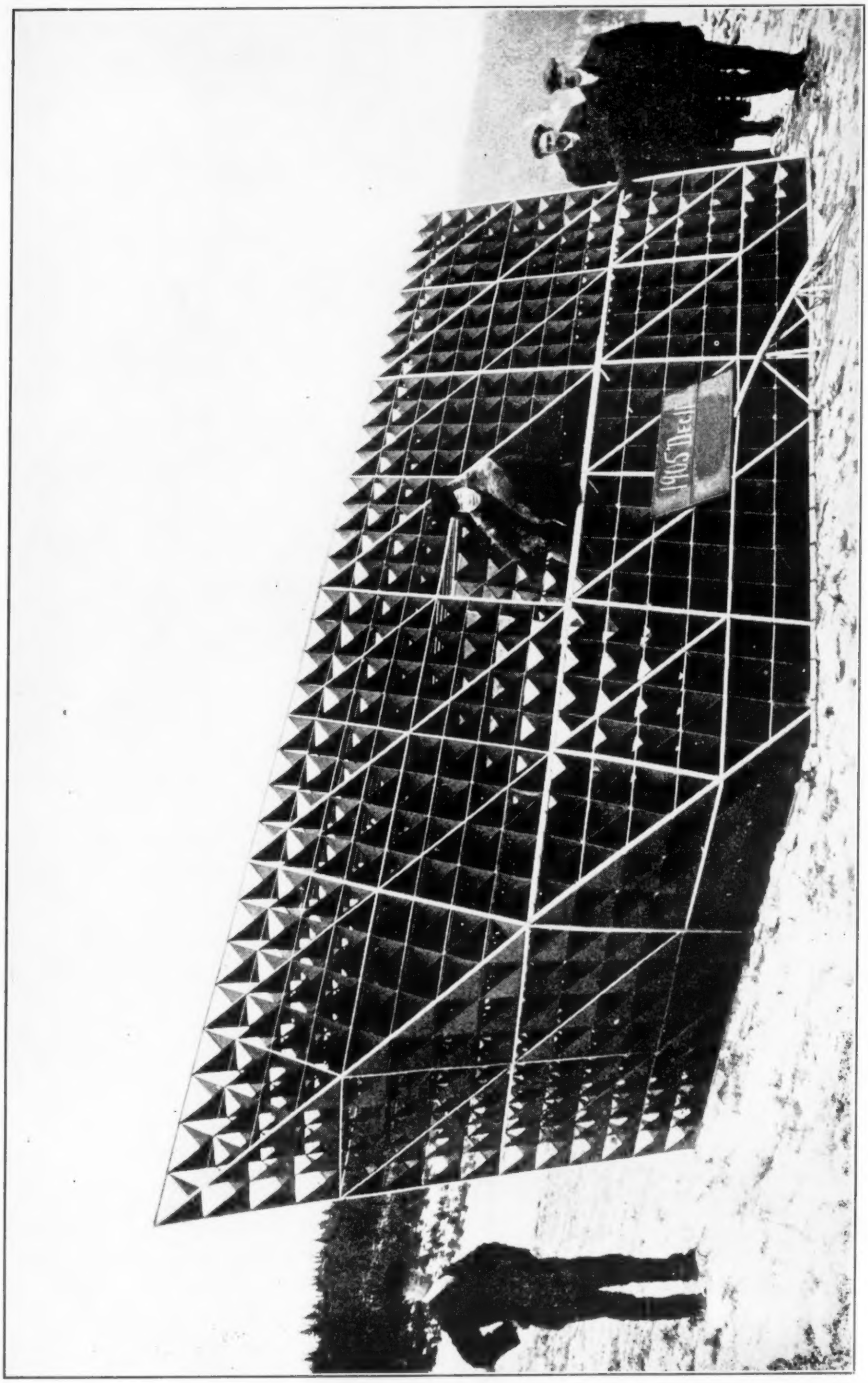
Of course, it would be premature for me to enter into any description of experiments that are still in progress, or to submit plans for an aërodrome which are still under discussion. I shall therefore simply say, in conclusion, that I have



Oionos Kite in the Air

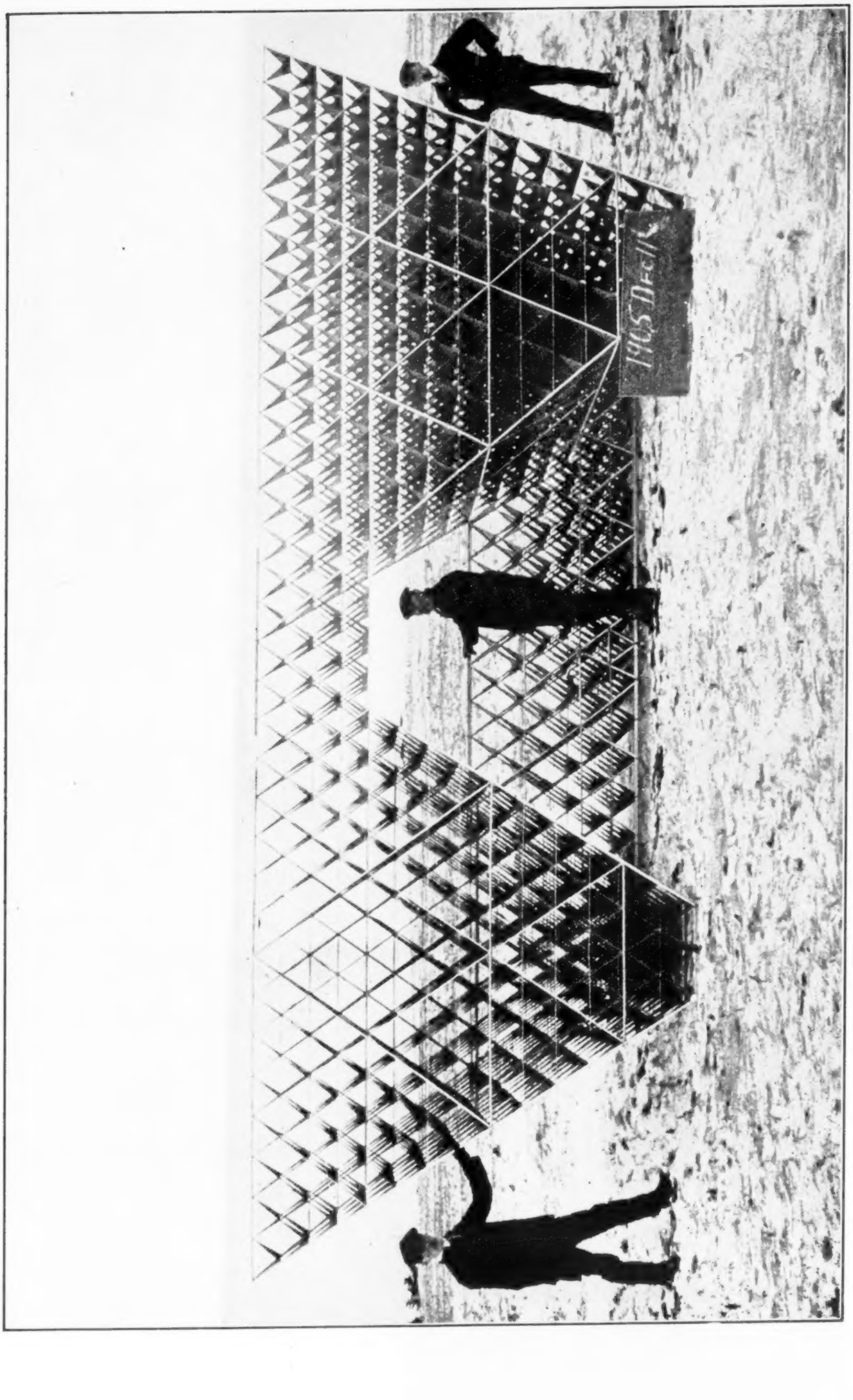
This name was applied by the ancient Greeks to the great solitary soaring birds, from which they drew their auguries

recently been making experiments in propelling, by means of aërial propellers, a life-raft supported, catamaran fashion, on two metallic cylinders. The whole arrangement, with a marine motor on board, is exceedingly heavy, weighing over 2,500 pounds, and it is sunk so low



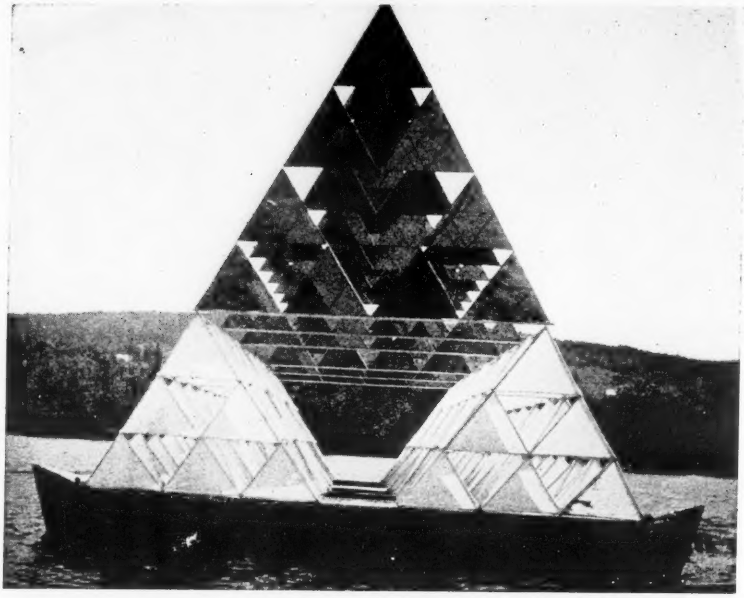
Kite "Siamese Twins" Seen from the Front

This kite was supported in the air by a strong wind exceeding, probably, 25 miles an hour. It was too heavy to be flown in a moderate breeze



Kite "Siamese Twins," Seen from the Rear, Looking Inside Kite

Composed of two distinct kites connected by a bridge, or truss, of strong cells, well beaded, for support of man



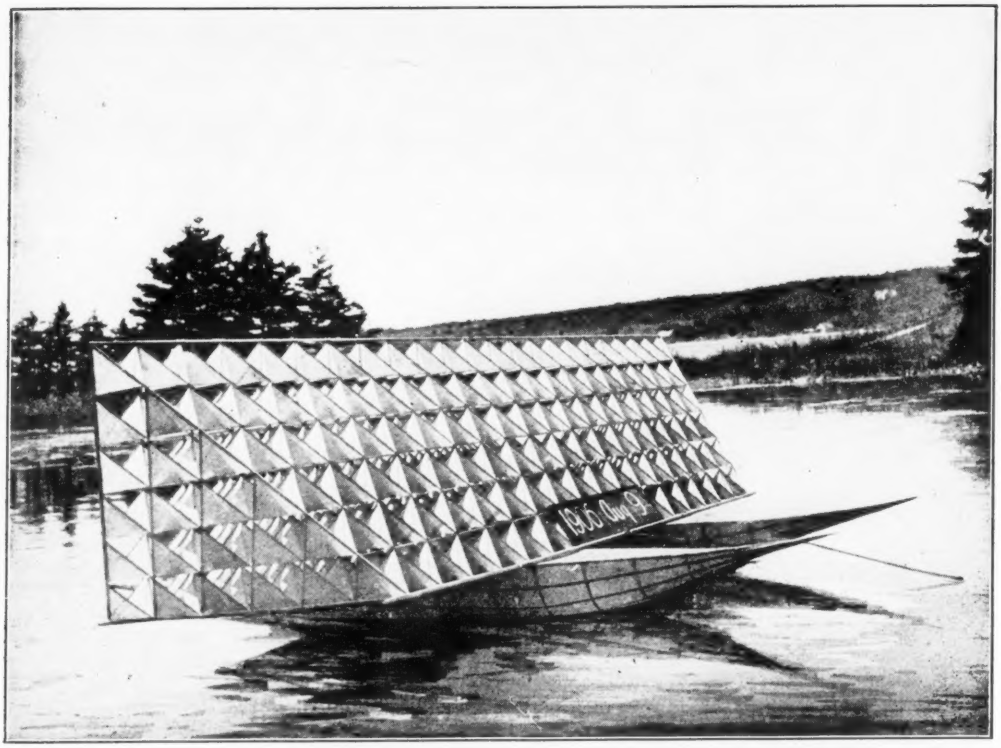
Side View of Mabel II

A floating kite supported upon three boat-like floats formed of tetrahedral cells and covered completely with oil-cloth. In September, 1903, this kite was raised into the air by being towed by a steamboat against the wind

Photos by Gilbert H. Grosvenor

Mabel II Outlined against Sky, Showing Bird-wing Effect

For experiments with this kite see "The Tetrahedral Kites of Dr Alexander Graham Bell," by Gilbert H. Grosvenor, *Popular Science Monthly*, December, 1903



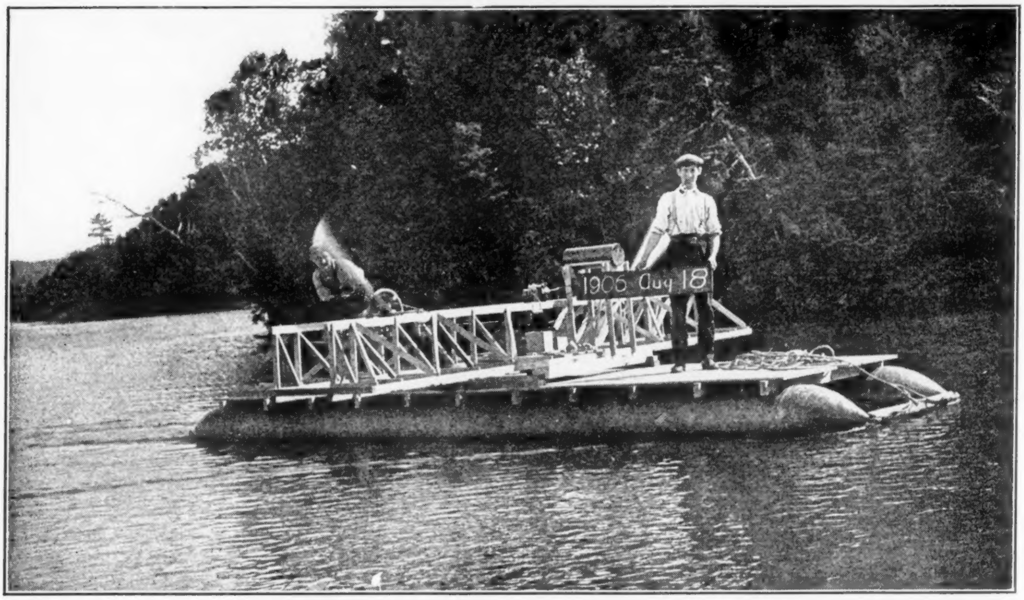
A Floating Kite, Adapted to Be Towed Out of the Water

Kite consists of a bridge, or truss, of tetrahedral cells with wings of Japanese waterproof paper upon two floats of light framework covered with oil-cloth. A stout towing pole extends laterally across the lower part of the wing-piece at the front. Photograph by Douglas McCurdy

that the water level rises at least to the middle of the supporting cylinders, so that the raft is not at all adapted for propulsion and cannot attain great speed. The great and unnecessary weight of this machine has led to an interesting and perhaps important discovery that might have escaped attention had the apparatus been lighter and better adapted for propulsion (page 26).

Under the action of her aërial propellers, this clumsy raft is unable to attain a higher speed than four miles an hour; and yet she is able to face a sixteen-mile white-cap breeze and make headway against it, instead of drifting backward with the wind. Under such circumstances her speed is materially reduced; but the point I would direct attention to is this: that she is not stopped by a current of air moving with very much greater velocity than her maximum possible speed in a calm. Of course, there would be nothing remarkable about this if her propellers were acting in the water instead of the air; but they were not. They acted exclusively in the air, and the water was only an additional resistance to be overcome.

It is worthy of note in this connection that the rapid rotation of the propellers yields a theoretical efficiency of thirty or forty miles an hour, and that the mass of the machine and the resistance of the water drag this down to an actual performance of only four miles; so that at first sight it appears probable that the effect noted may be a result of the



"The Ugly Duckling"

A raft supported upon metallic cylinders and propelled by aërial propellers. Above illustration shows raft propelled by small gasoline motor. In subsequent experiments referred to in the text, the bridge, or truss, supporting the propellers was raised considerably above the level of the platform, and the engine employed was a four-cylinder water-cooled marine motor weighing 650 pounds. This caused the metallic floats to be sunk to their middle points; but the floats were not connected together at their ends, as shown above

greater slip of the propellers acting in a calm. I am inclined to think, however, that this explanation is insufficient, and would suggest the following as more probable:

The enormous mass of the moving body enables it to acquire very considerable momentum with slight velocity, whereas the opposing current of air has such slight mass that it cannot acquire an equal momentum with a very much higher velocity.

If two bodies of unequal mass, moving with equal but opposite velocities, come into collision with one another, then the heavier body will not be completely stopped by the lighter. It will make headway against the resistance of the other, even though the lighter should possess superior velocity, provided, of course, that it has a sufficient superiority of mass. We are here dealing with momentum (mv), not velocity (v) alone. The body having the greatest momentum will be the victor in the struggle, whatever the actual velocities may be.

The suggestiveness of this result lies in its application to the flying-machine problem. A balloon, on account of its slight specific gravity, must ever be at the mercy of the wind. In order to make any headway against a current of air, it must itself acquire a velocity superior to the wind that opposes it. On the other hand, it is probable that a flying-machine of the heavier-than-air type, at whatever speed it moves, will be able to make headway against a wind of much greater velocity, provided its momentum is greater than the momentum of the air that opposes it.

APPENDIX A

DETAILS CONCERNING THE KITE "FROST KING"

Number of Cells in the "Frost King"

Layers of cells.	Number of rows.	Number of cells in each row.	Number of cells in each layer.
1st layer	1	24	24
2d layer	2	23	46
3d layer	3	22	66
4th layer	4	21	84
5th layer	5	20	100
6th layer	6	19	114
7th layer	7	18	126
8th layer	8	17	136
9th layer	9	16	144
10th layer	10	15	150
11th layer	11	14	154
12th layer	12	13	156
Total number of cells......			1,300

Dimensions.—Each cell had a side of 25 centimeters, so that the roof, or ridge-pole, measured 6 meters, extending laterally across the top of the structure. The oblique sides were 3 meters in length, and the bottom, or floor, formed a square having a side of 3 meters. The whole structure constituted a section of a tetrahedral kite—the upper half, in fact, of a kite having the form of a regular tetrahedron with a side of 6 meters.

Weight.—The winged cells composing this structure weighed on the average 13.84 gms. apiece, so that the whole cellular part of the structure which supported all the rest, consisting of 1,300 winged cells, weighed 17,992 gms.

In addition to this, the kite carried as dead load stout sticks of wood, which were run through the structure to distribute the strain of the pull upon the strong parts of the framework—that is, upon the junction points of the cells. The outside edge of the kite was also protected by a beading of wood. The whole strengthening material weighed 9,702 gms., and the kite as a whole weighed 27,694 gms. (61 lbs.).

Surface.—I estimate the surface of an equilateral triangle having a side of 25 centimeters as about 270.75 square centimeters; in which case the silk surface of a single winged cell consisting of two triangles amounts to 541.5 square centimeters, and the actual silk surface employed in 1,300 cells equals 70.3950 square meters (757.7 sq. ft.).

The surfaces are all oblique, and if we resolve the oblique surfaces into horizontal and vertical equivalents (supporting surfaces and steadying surfaces) we find that the resolved horizontal equivalent (supporting surface) of a single winged cell forms a square of which the diagonal measures 25 centimeters, and this is equivalent to a rectangular parallelogram of 25 x 12.5 centimeters, having an area of 312.5 square centimeters.

Thus an actual silk surface of 541.5 square centimeters arranged as the two wings of a winged cell yields a supporting surface of 312.5 square centimeters.

In kites, therefore, composed exclusively of tetrahedral winged cells each having a side of 25 centimeters, the area of supporting surface bears the same proportion to the actual surface as the numbers 3,125 to 5,415; or 1 to 1.7328.

$$\frac{\text{Supporting surface}}{\text{Actual surface}} = \frac{1}{1.7328}$$

A simple way of calculating the amount of supporting surface in such structures is to remember that there are 32 cells to the square meter of supporting surface; therefore the 1,300 cells of the kite "Frost King" had a supporting surface of 40.6250 square meters (437.3 sq. ft.).

Ratio of Weight to Surface.—The actual silk surface employed in the "Frost King" was 70.3950 square meters (757.7 sq. ft.), the weight of the kite was 27,694 gms. (61 lbs.); so that on the basis of the actual surface, the flying weight was 393.4 gms. per square meter (0.08 lbs. per sq. ft.).

But, for the purpose of comparing the flying weight of a tetrahedral kite with that of other kites, in which it is usual to estimate only the aëroplane surfaces that are substantially in a horizontal plane, it would be well to consider the ratio of weight to horizontal or supporting surface in this kite.

The weight was 27,694 gms. (61 lbs.), the resolved horizontal or supporting surface was equivalent to 40.6250 square meters (437.3 sq. ft.), and the flying weight for comparison with other kites was 681.7 gms. per square meter of supporting surface (0.14 lbs. per sq. ft.).

The kite, in addition to its own weight, carried up a mass of dangling ropes and a rope ladder, as well as two flying cords of manilla rope. The impedimenta of this kind weighed 28,148 gms. (62 lbs.). It also supported a man, Mr Neil McDermid, who hung on to the main flying rope at such a distance from the cleat attached to the ground that when the rope straightened under the strain of the kite he was carried up into the air to a height of about 10 meters (over 30 ft.). The weight of this man was 74,910 gms. (about 165 lbs.). Thus the total load carried by the kite, exclusive of its own weight, was 103,058 gms. (or 227 lbs.).

The whole kite, load and all, including the man, therefore, weighed 130,752 gms. (288 lbs.), and its flying weight was 1,857.4 gms. per square meter of actual surface (0.38 lbs. per sq. ft.), or 3,218.5 gms. per square meter of supporting surface (0.66 lbs. per sq. ft.).

A. G. B.

APPENDIX B

Partial Bibliography Relating to Aërial Locomotion, Prepared, through the Courtesy of the Smithsonian Institution, by Dr Cyrus Adler, Assistant Secretary, in Charge of Library and Exchanges

Dr Adler says:

"In accordance with your request, I am authorized to send you herewith a list of the writings of S. P. Langley, Octave Chanute, Otto Lilienthal, Lawrence Hargrave, and A. M. Herring, to be used in connection with your recent paper on aërial locomotion. I ought to explain that, excepting in the case of Mr Langley's writings, I am not at all sure that the lists are complete, since the time afforded for bringing together the references was very short, and of course there may be publications in out-of-the-way journals which would only be revealed by a more extended inquiry. I have also appended a list of papers on the subject published by the Smithsonian Institution, as the Smithsonian publications are accessible in all libraries throughout the country, whereas many of the publications cited in the other lists are not readily to be found."

S. P. LANGLEY

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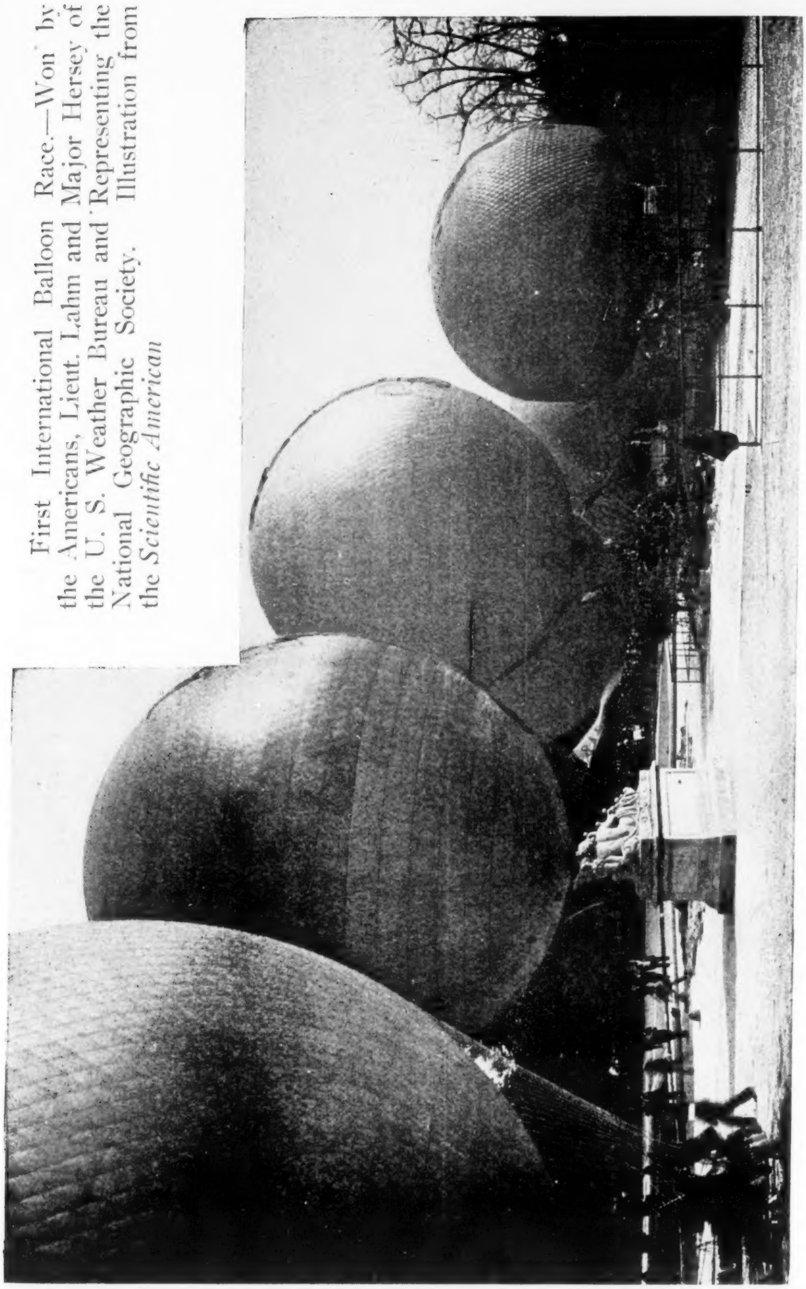
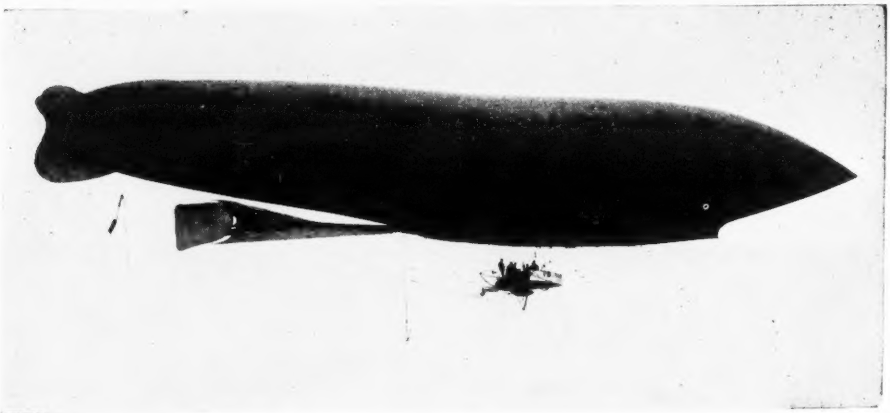
(*Continued on page 33*)



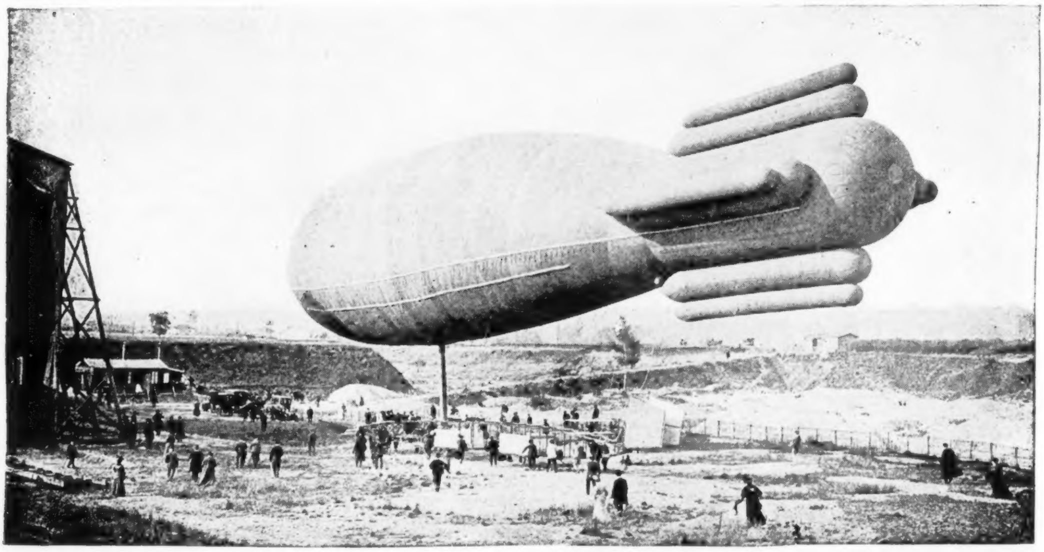
First International Balloon Race.—Won by the Americans, Lieut. Lahm and Major Hersey of the U. S. Weather Bureau and Representing the National Geographic Society. Illustration from the *Scientific American*

Some of the Balloons Which Took Part in the Great Race for the Gordon Bennett Cup



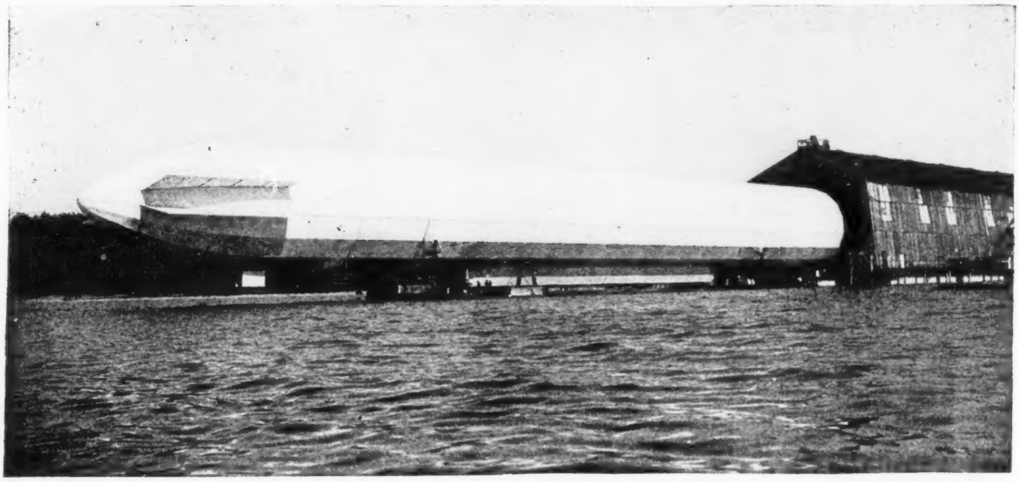
The French Military Dirigible, "Patrie," in Flight

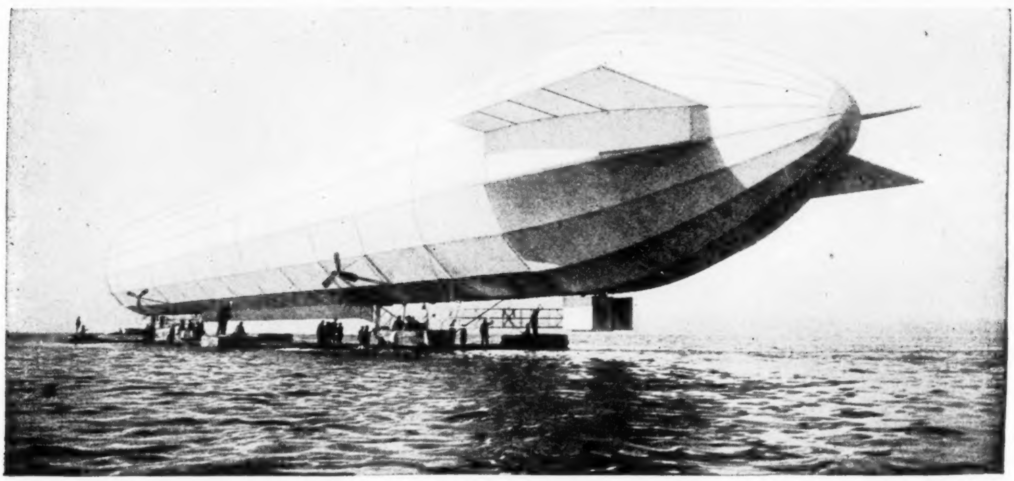
The latest French airship, "La Patrie," is 33¾ feet in diameter by 196 feet long, and has a capacity of 111,195 cubic feet. Driven by a 70-horsepower motor and two propellers, this dirigible has recently made about 30 miles an hour. Its lifting capacity is 2,777 pounds. Illustration from the *Scientific American*



The New Deutsch Airship "Ville de Paris," a Strange Looking Dirigible Balloon

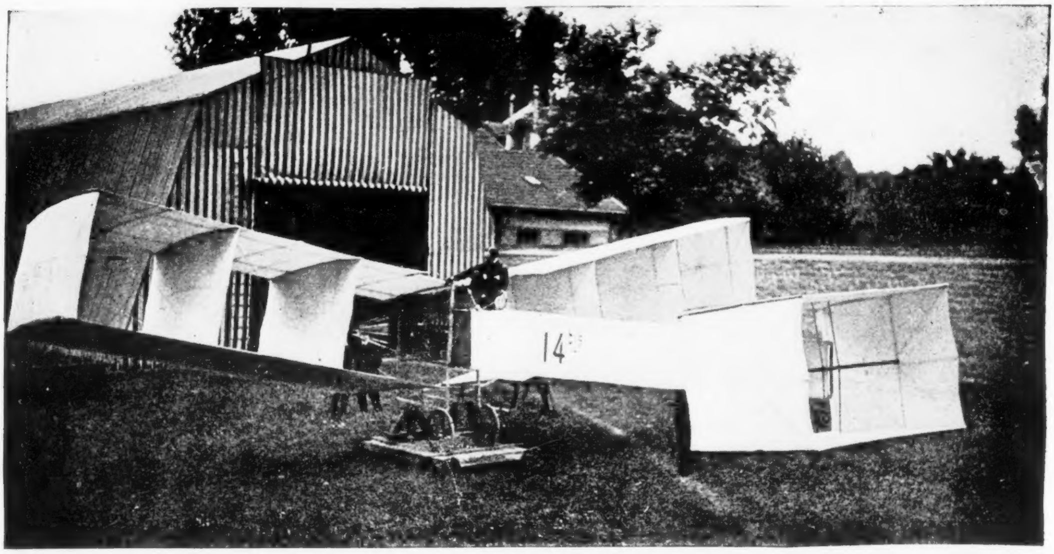
The peculiar arrangement of twin, hydrogen-filled cylinders forms a sort of balancing tail. This airship has a length of 60 meters (196.85 feet) and a diameter of 10.8 meters (35.43 feet), while its capacity is 3,000 cubic meters (105,943 cubic feet). Its propellers are placed on either side of the body framework or "nacelle," and at about the center of the latter, which is boat-shaped. The weight which can be carried, outside of the equipment and the fuel sufficient for a ten hours' run, is about 1,100 pounds. A 70-horsepower Panhard motor is used. Illustration from the *Scientific American*





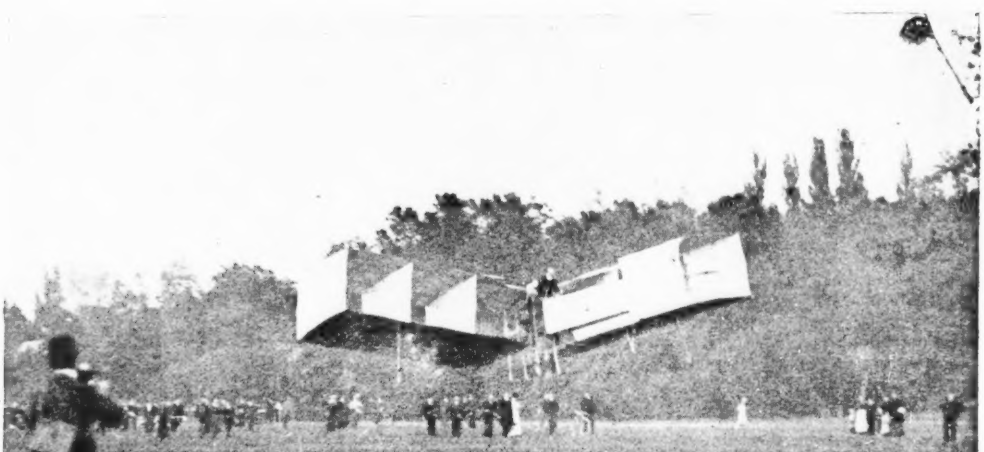
Count Von Zeppelin's Airship—the Largest and Fastest Thus Far Constructed—Coming Out of Its Shed and Performing Various Evolutions Above Lake Constance

This airship, which is 38 feet in diameter by 410 feet in length and which has a capacity of 367,120 cubic feet, held itself stationary against a 33½-mile-an-hour wind on January last, by means of two 35-horsepower gasoline motors driving four propellers. The airship can lift three tons additional to its own weight, which gives it a radius of 3,000 miles at 31 miles an hour. On October 11, 1906, Count Zeppelin maneuvered this dirigible balloon above Lake Geneva, ascending to a height of 2,500 feet and steering the huge cigar-shaped aërostat very nicely. The airship is mounted on floats, so that it works equally well on the water. During one flight it remained in the air an hour and twenty minutes, although the steering-gear was caught in the skeleton framework and became partly unmanageable. The attempts proved also that the airship was dirigible in spite of its great size, as several complete circles were made while in the air. Illustrations from the *Scientific American*



Santos-Dumont's Aëroplane

The inventor is seated on top of the basket, just ahead of the motor



The Aëroplane Making its First Successful Free Flight with its Owner in Control

The machine flew about 200 feet at an elevation of 10 feet from the ground. Illustrations from the *Scientific American*

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884	Langley, S. P.......	The Internal Work of the Wind............	Cont. to Knowledge.
938	Lilienthal, Otto	The Problem of Flying and Practical Experiments in Soaring.	Report, 1893.
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1248	....	Count Von Zeppelin's Dirigible Air Ship.....	Report, 1899.
1267	Janssen, J.	The Progress of Aeronautics...............	Report, 1900.
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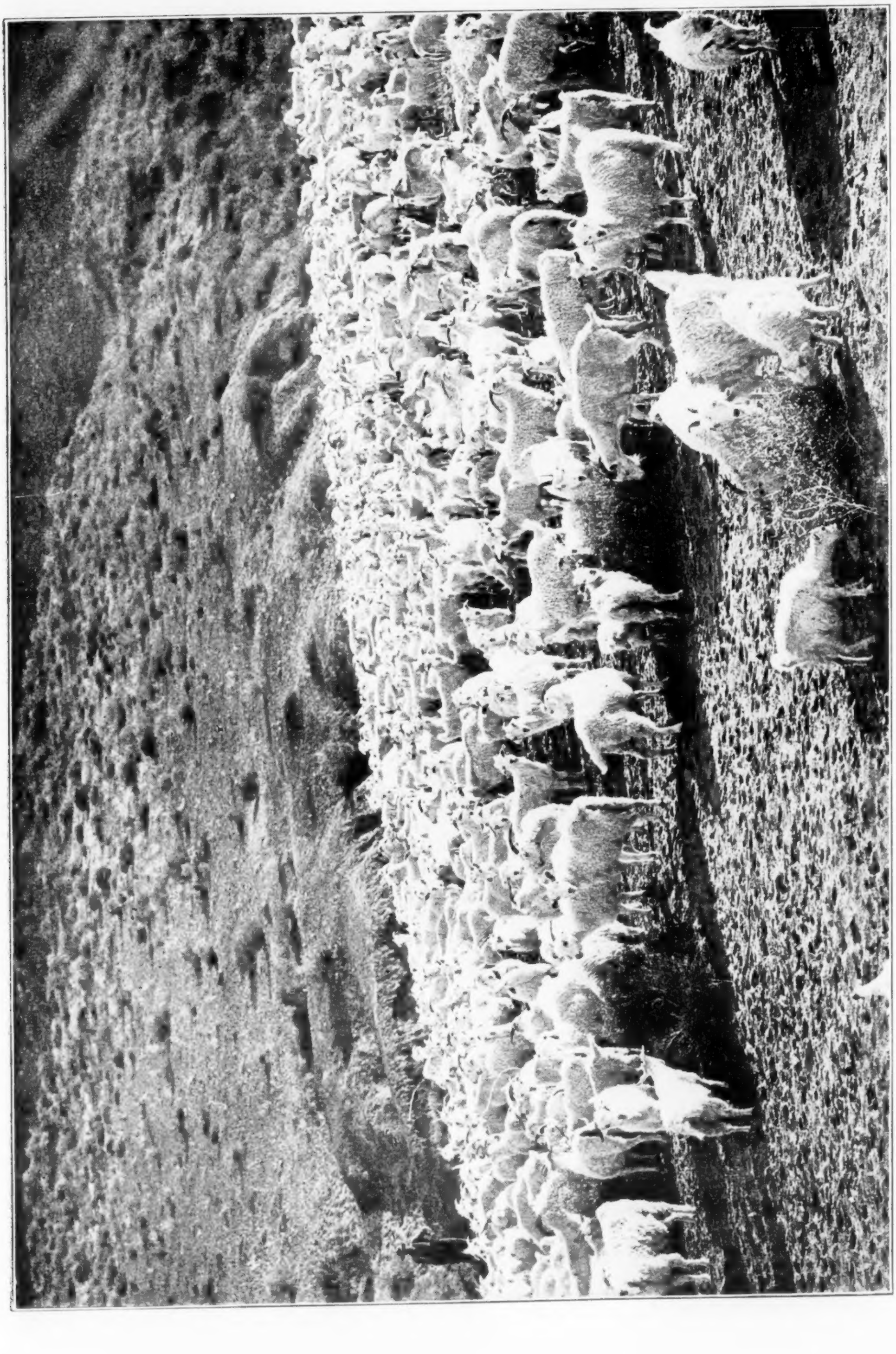
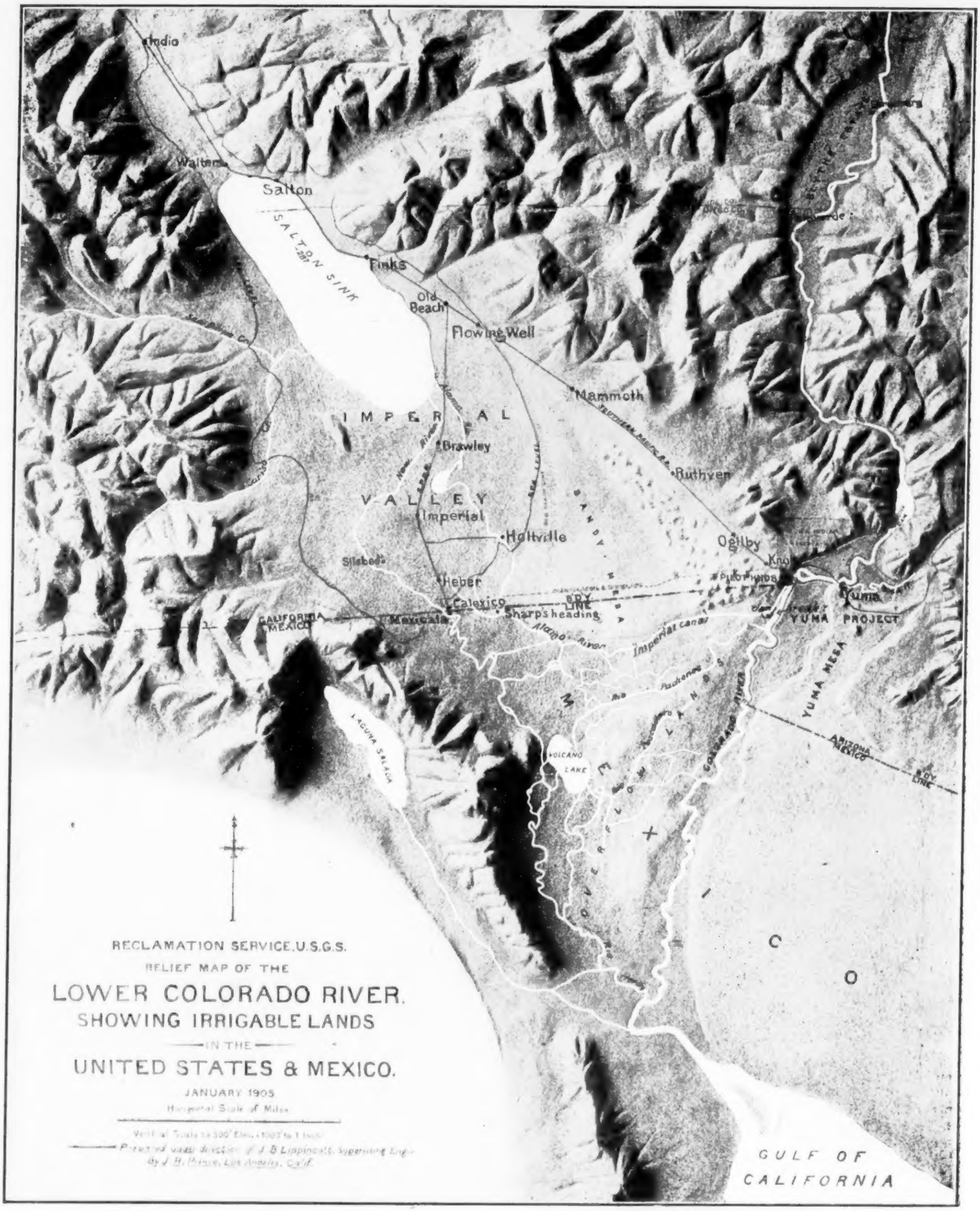


A Flock of Angora Goats in Our New State—Oklahoma



The Great New Lake Rising in the Salton Sink

The Colorado River is now flowing through the Imperial Canal into the Alamo River. Nine-tenths of the water leaves the Alamo River, however, at a point a few miles south of Sharp's Heading and rushes into the New River, and thence down into Salton Sink. Before this break occurred the Alamo and New Rivers were barely perceptible channels, filled with sand and sediment, and only occasionally carrying water. As the Salton Sink is nearly 300 feet below sea-level, the descending torrent has dug deep channels in the Alamo and New Rivers. These channels are preceded by huge cataracts, which are rapidly eating their way back and leaving the towns and canals without water. On November 4, 1906, a dam over 500 feet long was completed below Pilot Knob, which turned the river back into its old channel to the Gulf of California, but several weeks later the water worked its way around the dam, and the entire river is once more rushing down to the Salton Sink. The cataract in the New River is now rapidly approaching the Alamo, and if it once joins the Alamo, the Imperial Valley farms will be left high and dry until they are inundated by the rising Salton Lake

THE NEW INLAND SEA*

By Mr Arthur P. Davis

Assistant Chief Engineer, U. S. Reclamation Service

MANY centuries ago the Gulf of California extended to a point about 150 miles northwestward from its present head. It also extended up the present valley of the Colorado River at least to Yuma and probably somewhat above. The Colorado River, rising in the Wind River Mountains of Wyoming and the Rocky Mountains of Colorado, carved the rocks along its course and brought the resulting sands and mud down in its swift current, discharging them into the arm of the gulf near Yuma. As this process went on, without cessation, century after century, the valley was gradually filled, a delta built up, over which the river flowed far out into the gulf. It encroached progressively upon the shores of the gulf until it built up a delta entirely across, joining the foothills of the Cocopah Mountains on the western shore. This cut off the head of the gulf, and the arid climate rapidly evaporated the waters thus separated and left an inland depression, which at its lowest point was nearly 300 feet below sea-level.†

The river continued to bring down its load of sediment and to build its delta higher and force it farther into the gulf. Like all such deltaic streams, the channel on the top of the delta is constantly shifting, cutting one bank, building up the other, overflowing both banks, and during high water sometimes entirely abandoning an old channel for a new one. In this way the river has from time to time flowed into the Salton Sea for some years or centuries, and anon has shifted to the eastward and discharged again into the gulf. This is the general course the river has followed ever since its discovery by the Spaniards in the 16th century. At high water the river normally overflows its banks in the valley regions all the way from the Grand Canyon to the Gulf of California. In unusually high water, such as occurred in 1891, the overflow running into the Salton Sink has been sufficient to materially raise the level of the lake and overflow the tracks of the Southern Pacific Railway, which are built along its shores.

THE IRRIGATING COMPANY RESPONSIBLE FOR THE BREAK

The ease of diverting the Colorado River near the international line and conducting the water through natural channels to the Colorado Desert for irrigation has been recognized for many years, and various attempts to promote this project have been made from time to time, usually, however, without success, owing to the international complications involved.

About 1891 Mr C. R. Rockwood, a civil engineer, made plans for the construction of a headgate in rock at the foot of Pilot Knob, just north of the Mexican line, and of a canal to carry the water to the so-called Alamo River, an ancient channel of the Colorado which, by lapse of centuries, had been nearly filled with sand and sediment. Efforts to promote this project were for nearly 10 years unsuccessful, but finally a small amount of money was raised, which, however, was insufficient for the construction of the works as planned. The promoters then concluded simply to cut the dirt banks of the river and lead the water by a small canal into an old channel, whence it flowed into the Imperial Valley without additional construction. A cheap wooden headgate was built in the canal near the river and was for a

* An address to the National Geographic Society, November 23, 1906.

† It is estimated that the amount of silt carried by the Lower Colorado River is sufficient to cover 53 square miles one foot deep with dry alluvial soil each year.

time used in the control of the waters. The water was diverted from the Alamo channel at a point called Sharp's Heading, just below the Mexican line, in the southern edge of the Imperial Valley. The water was led by canals over the land to be irrigated and settlement began.

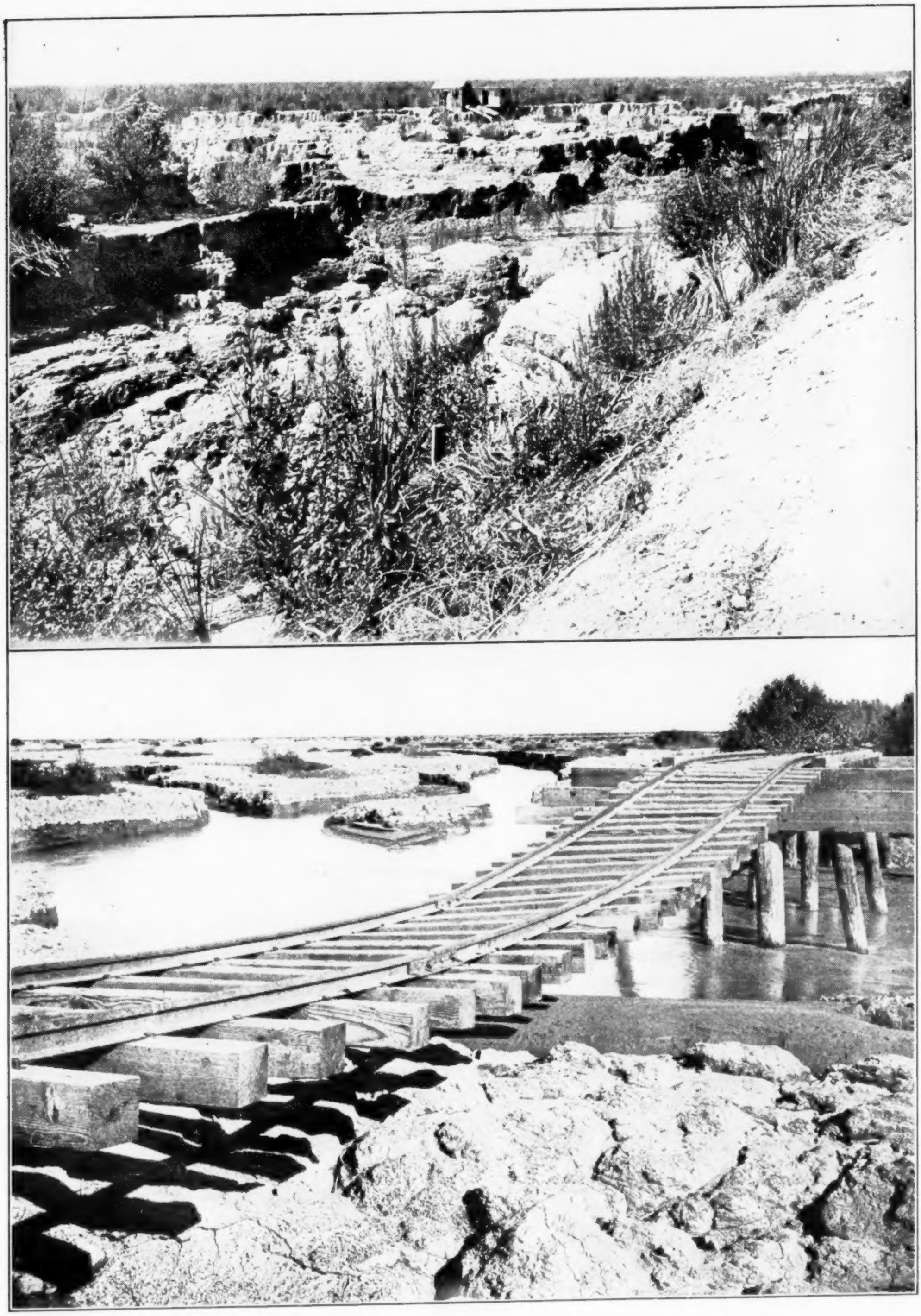
The headquarters of the irrigation company were established at a town called Calexico, adjoining the Mexican line, this name being derived by substituting the first syllable of the word "California" for the first letter of "Mexico." Settlers gradually came in and, the valley proving to be very fertile, development proceeded apace. As the demand for water became greater, however, the supply became less. The muddy waters of the Colorado River, checked by their entrance into the artificial channel, and still further checked by the obstruction of the headgate, deposited their load of mud, and constant effort was necessary to keep the heading open. The unsuccessful attempts to maintain the canal heading led to its abandonment and to the cutting of a new one near by in which no headgates were provided. This gave somewhat less trouble, but it, too, gradually began to fill and the effort at maintenance had to be continued. Several new headings were cut for the same reason, and serious losses occurred in the Imperial Valley from shortage of water during the time when most needed, owing to the difficulty of getting sufficient water into the head of the canal.

After repeated failures of the effort to maintain an open canal heading, the company finally went to a point about four miles below the Mexican line, where a greater declivity from the river bank could be obtained in a shorter distance, and there cut a large channel, with the idea of obtaining a sufficient velocity of water to prevent the deposit of sediment in the canal heading. In this respect the attempt proved successful, and throughout the low-water season of 1904-05, which occurs in winter, a large supply of water was furnished through this channel, sufficient for the irrigation of about 75,000 acres of land, most of which was under cultivation in the Imperial Valley. The Southern Pacific Railroad built a branch road from Old Beach through Brawley, Imperial, and Holtville to Calexico, and began building through Mexican territory from Calexico to Yuma, intending to make this the main line and cut out some heavy grades now encountered between Pilot Knob and Yuma.

THE BREAK OF JUNE, 1905

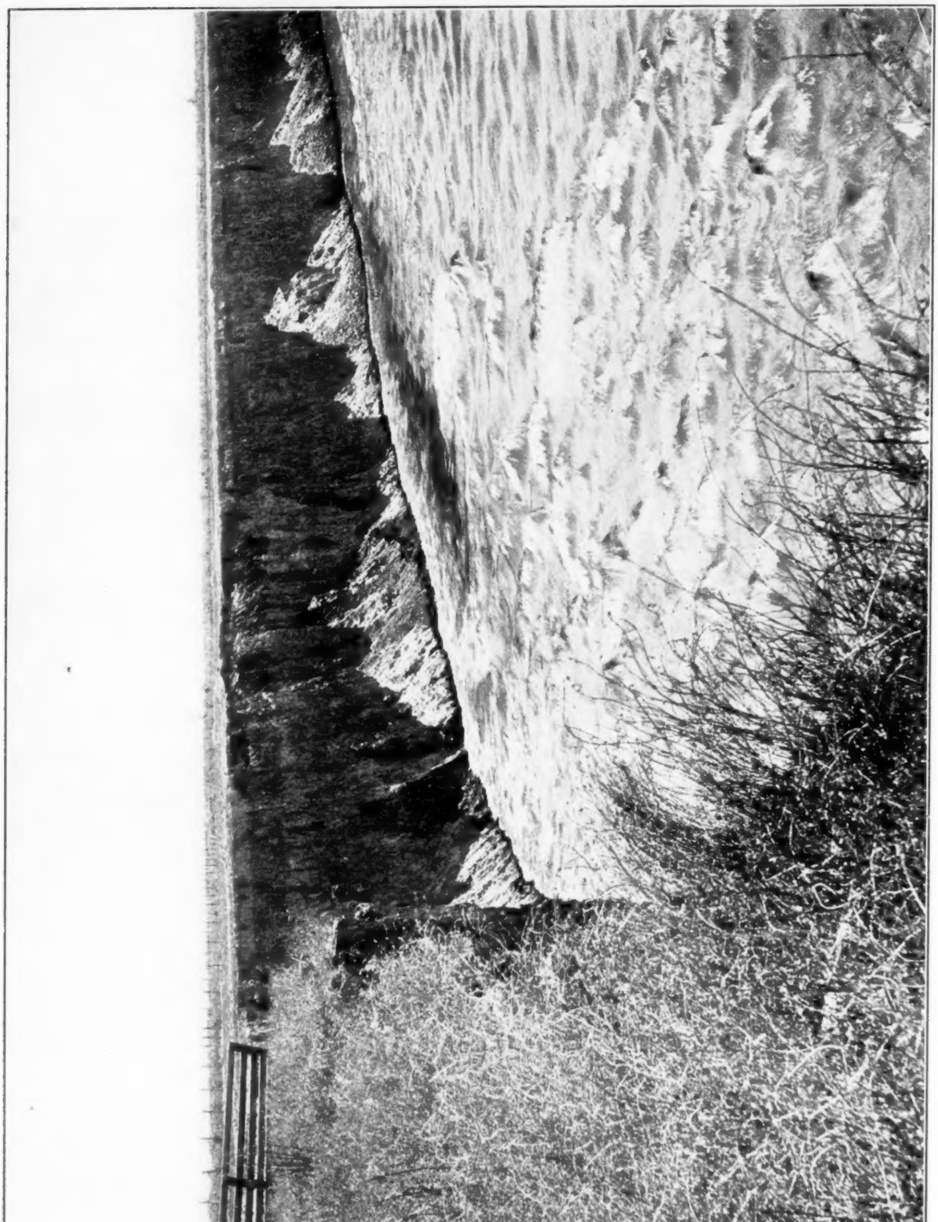
The large new heading in Mexico maintained itself without silting throughout the low-water season, but when the annual flood of May arrived the larger volume of water and the consequent increase in velocity began cutting the channel, and in June it was found that the volume of water running toward the Imperial Valley was many times that required for irrigation and was rapidly cutting the channel wider and deeper. By the end of August, 1905, the majority of the water of the Colorado River was flowing toward the westward instead of the south, and the Salton Sea was rapidly rising and submerging portions of the Southern Pacific Railroad track, which were hurriedly moved to higher ground.

The distance from Yuma to the Gulf of California along the general course of the Colorado River is about 75 miles. The distance to the Salton Sea is not very much greater, but the difference in elevation between the gulf and the Salton Sea is about 280 feet. The gradient from Yuma to the gulf is about two feet per mile along the windings of the river, which is the natural gradient adopted by this river under the circumstances with which it is beset. The channel to the Salton Sea, therefore, had more than 200 feet surplus declivity, so that the water in running through that channel was rapidly eroding its bed. It cut the gorge wider and deeper near the Salton Sink and formed great falls or cataracts in the channel. The channels near the vicinity of Calexico had been so nearly obliterated with the lapse of time that



A Section of the Imperial Valley Which Was at First Inundated and Then Left High and Dry by the Deepening Channel

This photograph shows how the Southern Pacific Railroad tracks were cut into and washed out before the river found any channel or before the channel had cut any depth in the ground. Location, 6½ miles southeast of Calexico



This photograph shows the way in which acres and acres of fine farm lands are undermined and washed into the New River channel. It was taken $4\frac{1}{2}$ miles northeast of the town of Brawley, California

the waters spread over a large area of the country, and as the quantity increased threatened to engulf the farms and the town of Calexico. Large dikes were hurriedly built to shut out the water, and the town was thus saved from disastrous inundation before the waters rose high enough to sweep it away. In the meantime channels formed near the Salton Sea, and were cutting deeper and deeper, the cataracts therein were advancing upstream as the water undermined them and carried the debris into the sea. As these cataracts advanced upstream they left below them, of course, deep channels, which carried all the water far below the surface of the surrounding country to the Salton Sea. In the early part of the present year the cataract in New River had reached Calexico, after which, instead of threatening to overflow this town, the water was in a gorge 45 feet below the surrounding country. Opposite Imperial the channel of New River is over 80 feet in depth and that of the Alamo nearly as deep.

The large amount of water flowing down the Alamo River was rapidly eroding this channel throughout its course. Sharp's Heading is a cheap wooden structure and has been for some time in imminent danger of washing out, which would have left the canals of Imperial Valley without water for irrigation, though domestic water might have been obtained with great effort from the deep channels of the Alamo and New rivers.

THE RETREATING CATARACT

The deep channel in the Alamo River, which passed Holtville in August, was gradually approaching Sharp's Heading, and it was recognized that when this cataract reached the heading it would be very difficult and expensive, and perhaps impossible, to maintain that heading. This, however, was not the only peril to the water supply of the valley. The channel of New River had eroded to such an extent that where the two streams separated it was estimated that four-fifths of the water was running down New River and only one-fifth down the Alamo. While this proportion was favorable to the regimen of the Alamo and the safety of Sharp's Heading, it was very threatening in another respect. It accelerated the cutting of the New River channel, in which was a great cataract four or five miles below the separation of the two streams, and this was, of course, advancing upstream. It was well recognized that when this cataract reached the Alamo the channel would be so deep that all of the water would run down New River and leave Sharp's Heading on dry land, without any water for the irrigation of the Imperial Valley. Threatened first with inundation, and next with the destruction of their entire water supply, the inhabitants of the Imperial Valley have naturally been almost in a state of panic for several months.

THE SAFETY OF $100,000,000 IN THE BALANCE

The continuation of the flow of the Colorado River into the Salton Sea meant the gradual inundation of the entire Imperial Valley. Whether the lake would ever rise high enough to actually flow out through Volcano Lake to the Gulf of California is problematical. Volcano Lake is about 30 feet above sea-level. Taking the mean annual discharge of the Colorado River at 9,000,000 acre-feet and the evaporation at 6 feet in depth per annum, the lake would fill in 40 to 50 years and would flow a considerable stream perennially into the Gulf of California. But taking the more probable values of 8,000,000 acre-feet for the mean annual inflow and 7 feet in depth for the mean annual evaporation, the depression would never fill. It would rise to a point 8 or 10 feet above sea-level and oscillate above and below this level in accordance with the fluctuating annual discharge of the Colorado River.

Either result, however, would have been destructive of enormous interests. It would have submerged 150 miles of

the railroad track of the Southern Pacific road, and would have required extensive alterations of its alignment in the vicinity of Yuma. The rapid erosion of the channel leading to the Salton Sea would advance upstream slowly but surely. It has already cut the channel at Yuma two or three feet below the former level. This cutting would be continued until the 200 odd feet of excess fall in the channel had been distributed up the Colorado River, eventually, perhaps, as far as The Needles. It certainly would have cut a deep channel up to Parker—so deep that it would probably have been entirely impracticable to dam and divert the Colorado River at any point below Bill Williams Fork, and thus it would have become impossible to irrigate the great valleys of the Colorado River. These valleys aggregate about 400,000 acres. It is estimated that there are 300,000 acres of fertile irrigable land in the Imperial Valley and twice as much more, in the Colorado delta in Mexico. The lands referred to are now settled by a population of 12,000 to 15,000 people, most of whom would have had to abandon their homes.

It may be said, therefore, that during the past year the fate of 700,000 acres of fine irrigable land, in a semi-tropical climate, the homes of over 12,000 people, and 150 miles of railroad track have been trembling in the balance. It is impossible to assign definite values to all these elements, but $100,000,000 would not be an overestimate.

The railroad company spent immense sums of money in repeated removals of its track, as the shores of the Salton Sea grew higher and higher, and also experienced great difficulty in preventing the destruction of its bridge across the Alamo River, as the channel cut deeper and wider. The railroad company appreciated the gravity of the situation in the summer of 1905 and made a large loan to the irrigation company for the purpose of damming the channel. Repeated efforts to do this were unsuccessful, and the control of the irrigation company passed into the hands of representatives of the railroad company. About one year ago the construction of a dam across the new channel was in progress, and strong hopes were entertained by the railroad people of the success of the attempt, when a very large and unexpected flood came down the river, which carried away the works and left the situation more threatening than ever. As soon as the water subsided sufficiently the efforts were renewed and continued throughout the spring of 1906 without success. When high water came in May the company was obliged to abandon its efforts until after the flood season. The heavy discharge of the river during May, June, and July nearly all went down the Alamo and New rivers and cut the channels larger and larger. The railroad south of the Mexican line was entirely washed away, the former site finally becoming a deep channel.

THE DESTRUCTIVE CATARACTS

The cataract in New River advanced upstream past Calexico, took away some of the buildings of that town, and nearly all of the buildings of the Mexican village of Mexicala, and continued to advance eastward at a threatening rate. The Alamo River cut back similarly, and in August, 1906, the cataract had passed the town of Holtville and caused the temporary shutting down of the power plant at that place. In the endeavor to prevent the destruction of valuable buildings and farms, the people made strenuous attempts to guide the cutting of the water by the use of dynamite to assist the cutting where it would do less damage than if left to its own inclinations. It is not apparent, however, that any great benefit resulted from these attempts. During the high-water season of 1906 the irrigation company made two plans for the diversion of the destructive waters. One of these, the success of which was relied upon, was the construction of large headgates at the foot of Pilot Knob, substantially

as originally planned by the engineers. It was planned to dig a channel from the river above these headgates large enough and deep enough to divert the water without very much obstruction and carry it to the Alamo River below its junction with the Colorado. This would leave the new channel dry and permit a dam to be built there and levees along the river to close the disastrous break. This work, however, required a very large amount of excavation, estimated to cost nearly a million dollars. The headgates were built, but no sufficient machinery was available for the excavation, and the construction of a mammoth dredge was undertaken at Yuma. This dredge, mounted upon an enormous pontoon, was to have a capacity of lifting about six tons of material at once, and is now finished and at work.

Realizing the large amount of time that would be required for this excavation, and in the face of the heavy cost of repeatedly moving its tracks onto higher and rockier ground along the Salton Sea, the company concluded to make a preliminary attempt to dam the new channel by constructing a by-pass around the proposed dam site, through which the water could flow as the dam raised it higher and higher. Wooden headgates were built in the by-pass, and in August the construction of the dam was commenced.

DESPERATE ATTEMPTS TO REGAIN CONTROL

At this period the situation looked very gloomy; every condition was unfavorable; the river, instead of coming down to its normal low water, was discharging nearly twice as much water as it ordinarily does at that time of year. The large amount of construction in progress in the Southwest made it extremely difficult to obtain and keep laborers in the hot climate and primitive surroundings of a construction camp. The great heat also made it extremely difficult to employ animals to advantage in excavation or transportation of material. The heavy demands made upon rolling stock made it very difficult and expensive for the railroad company to transport materials for this construction; but, in spite of all these difficulties, the officials, with commendable energy, poured money and men into the breach with an unstinted hand, with the determination to make this effort successful. It was recognized that the work was daily becoming more difficult; the channel was cutting deeper and deeper, and if the river were not controlled during the present low-water season it probably never could be, as another high-water season would cut the channel so deep that, without rock foundation or any means of holding a large structure, it would be impossible, or at least enormously expensive, to accomplish the work the following or any subsequent year.

A railroad was built from the main line to the proposed dam site and continued across the river on piling; a large camp was constructed and laborers assembled; huge pile-drivers and dredges were brought to the ground, and piles were driven at intervals across the channel where it was proposed to build the dam. At points about 500 feet apart in the river and along the located line of the trestle, two bulkheads were built, one composed mostly of rock and brush on the south side, and the other almost entirely of fascines, on the north side. A mat 100 feet long, up and down stream, was placed on the bottom between these abutments, the piles of the trestle pinning the mat to the bottom. Over part of this mat a second mat was placed.

Immediately after the construction of the railway across the river the operation of building the remaining 500 feet of dam between the two abutments was begun. Steam shovels loaded 40-yard automatic dump cars at quarries four miles away, and train-loads of these cars were run out on the trestle and dumped into the river upon the mat. Gradually the river rose, until on October 10 the difference in elevation of the water above and below the dam was six feet, and practically the whole river was flowing through the gates.

The engineers in charge had detected cutting in front of and below the gates, and in anticipation of their failure had built a trestle across the river above the gates, with the intention of dumping in enough rock to partially close the gates and relieve the situation there. At 3.15 on Thursday, October 11, a large part of this gate, known as the Rockwood gate, went out. The river rapidly scoured a deep channel, lowering the surface of the water above the dam until there was only a difference in elevation of about three feet. Work was immediately begun on repairing the trestle below the gates, which had been injured both by the increased flow and by the timber carried away from the gate. From all the available quarries within a radius of from three to four hundred miles, rock was hurried to this point and dumped rapidly from the lower trestle. At the same time the trestle which had been started above the gates was strengthened, and as soon as it was in shape cars were run out on that and rock dumped in. In the meantime part of the material that had been dumped between the two abutments in the river and over which the overflow had taken place was removed and gradually the channel through the Rockwood gate was filled up.

When this was entirely filled, so as to throw the entire flow of the river over the central portion of the dam, the filling of this portion was again resumed. Large blocks of granite weighing several tons, as well as smaller material, was hauled out as rapidly as trains could bring it and gradually the gap was closed.

The river during all this time did not go below about 9,000 second-feet, adding materially to the difficulties expected.

On November 1 there was an eleven-foot difference in the elevation between the water below and above the dam and about one-half the water in the Colorado was going down its old channel. By noon of November 4 the dam was high enough so that practically the entire flow of the Colorado River was returned to its old channel, and since this time the work has steadily gone on raising the dam and riprapping its upstream and down stream slope.

Great credit is due to Mr Epes Randolph, general manager, and Mr H. T. Corey, engineer in charge, for the energy and skill with which this work was handled.

HOW SOON WILL THE LAKE DRY UP?

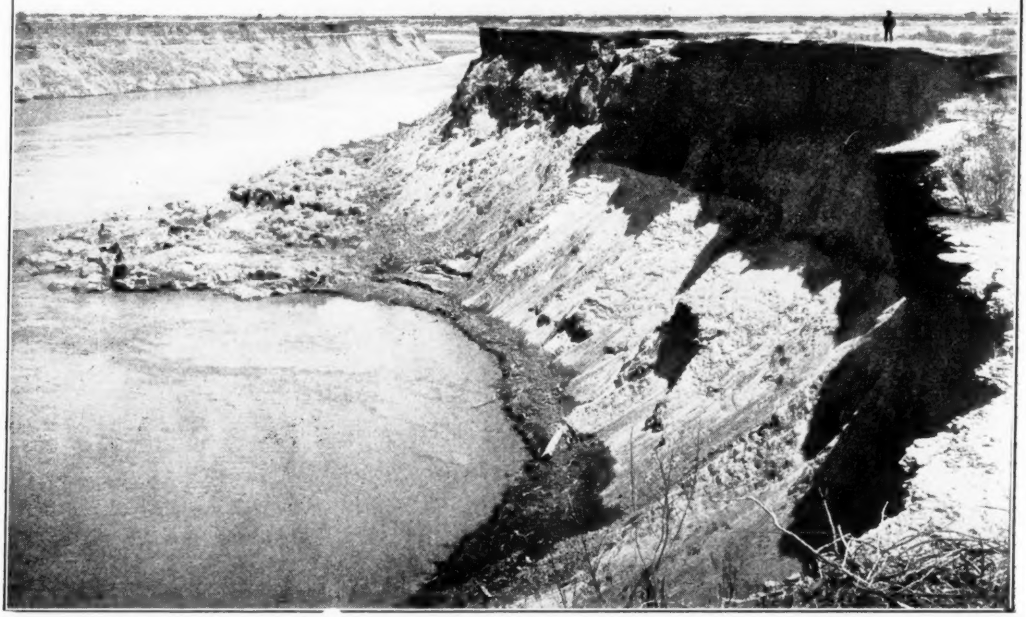
The area of the present Salton Sea is over 400 square miles, and its depth about 90 feet. If the river discharges no water into the sea, it will probably dry up in about 10 or 12 years.

Levees must be built along the entire western bank of the Colorado River from Pilot Knob to high ground far into Mexico, probably 15 to 20 miles, because if high water ever overflows this river again and reaches the deep channel which now exists there, it will rapidly erode the channel back to the river and the disaster of 1905 will be repeated.

In order to prevent the Imperial Valley being deprived of water for irrigation, it is necessary to build a new canal from the headgates at Pilot Knob to the channel of the Alamo River. This can doubtless be completed in a few months, and some water is already flowing through the old Imperial Canal, which is approximately along the same line, so there is no danger to the people of the Imperial Valley.

Some persons have suggested that the existence of the Salton Sea during the past year has had a tremendous effect upon the climate in that vicinity in Arizona, and even as far east as Texas and New Mexico. Much publicity has been given to this idea, it having been caught up by newspapers as something worthy of a story.

The absurdity of any such idea may be inferred when we notice that only a short distance to the southward of the Salton Sea occurs the great inland Gulf of California, which is hundreds of times larger than the Salton Sea, and yet there is no very marked influence upon the



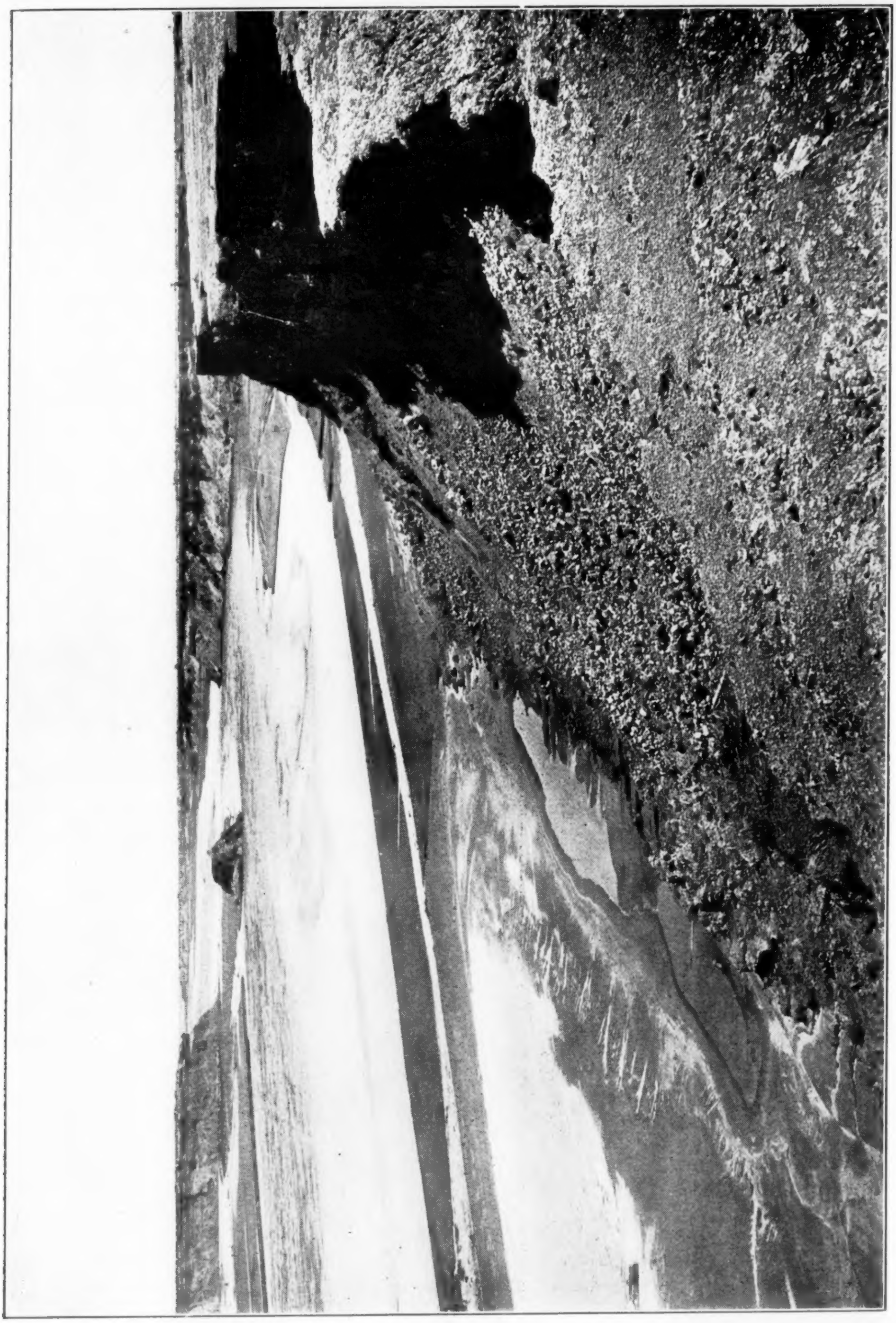
Cutting Work of the New River

This photograph shows how the Mexican town called Mexicala was partly destroyed by the New River cutting into the town at this point

Cut and washed banks in the big bend of the New River, 5 miles northwest of the town of Imperial, California. These banks are from 60 to 80 feet in height and are constantly caving into the river bed and washing away, consequently widening the river and cutting back onto the farm lands

The Great Salton Sea, 205 Feet Below Sea-level at this Point, Near the Salton Station on the Southern Pacific Railroad

Brush dam at the headworks of the California Development Company's dam in the Colorado River, just below the old river bed



A few months ago this was fertile land cultivated by prosperous people. Looking down New River canyon from a point in big bend, 5 miles northwest of Imperial, California

climate. Besides being so much larger, the Gulf of California is somewhat nearer Arizona, New Mexico, and Texas and is separated from them by fewer mountain chains. If any influence could be exercised by the Salton Sea, hundreds or even thousands of times as much influence would be exercised by the gulf itself; yet no such influence can be detected in that vicinity.

Those who hold to this idea apparently ignore or neglect the fact that the same causes that have led to the creation of the Salton Sea have led to the cutting down of the bed of the Colorado River and the prevention of its normal annual overflow at Yuma and all points below there. The great delta, therefore, which is annually overflowed under normal conditions has received no such overflow since the river has been running into the Salton Sea, at least during the past high-water season, and this fact itself would counteract any influence that might have been exerted by the evaporation from the surface of the Salton Sea.

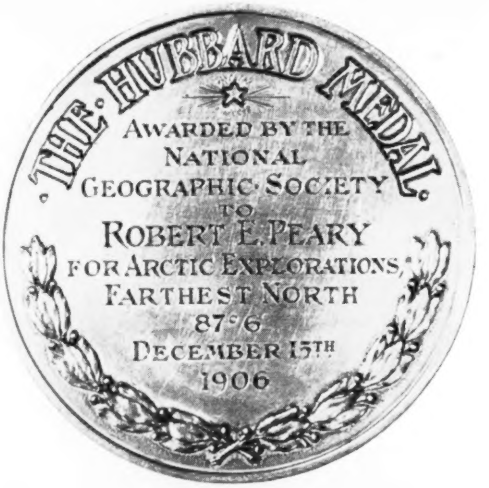
Climate is the result of great cosmic influences so great and extensive that the Salton Sea would be a neglible quantity beside them.

CONDITIONS WORSE THAN BEFORE

A few days after this address was delivered, the Colorado River worked its way around the dam, which had been built at cost of so much labor and money, and plunged on again to the Salton Sink. The flow of water has been unusually great for this time of year, which complicates the situation. The cataract of the New River has now advanced a long way above Mexicala and is rapidly approaching the Alamo. If the cataract once joins the Alamo the entire Imperial Valley will be cut off from water, and left high and dry until the new Salton Lake has risen sufficiently to inundate the entire region.

Some perplexing questions as to who is responsible for the damages will arise, for the company whose carelessness caused the break is chartered under the laws of Mexico, while all the capital and all the stockholders are American. The break, furthermore, occurred in Mexican territory.

The Southern Pacific Railway is making Herculean efforts to turn back the river, but the situation has become very desperate.



The Hubbard Medal of the National Geographic Society, the First Award of Which was Made to Commander Peary December 15, 1906

Not only the people in the Imperial Valley are threatened, but also the Laguna Dam above Yuma, which has been built at a cost of one million dollars. The great cataract, which resembles Niagara Falls and is 1,500 to 1,800 yards wide and has a fall of 90 to 100 feet, is working backward at the rate of one-third of a mile a day. If not checked it will reach and destroy the Laguna Dam, and ultimately deprive of water every farm along the Colorado River up to the Grand Canyon, causing a damage of approximately one billion dollars.

HONORS TO PEARY

An account of the presentation of the Hubbard Medal to Commander Robert E. Peary, U. S. Navy, by President Roosevelt, on behalf of the National Geographic Society, at the annual dinner of the Society, December 15, 1906, with the congratulatory addresses of President Roosevelt, the Italian Ambassador, and the Secretary of the Navy, and Mr Peary's responses.

ABOUT 400 members and guests of the National Geographic Society united to pay honor to Commander Robert E. Peary, U. S. Navy, on the occasion of the annual banquet of the Society, December 15, 1906. Ten nations were represented by members of the diplomatic corps and 20 states by Senators and Representatives. A number of members came from New York and Philadelphia to attend. The feature of the evening was the presentation of the Hubbard Medal to Mr Peary by President Roosevelt on behalf of the Society. The medal was specially struck for the occasion, being made by Tiffany & Co., of New York, under the direction of Mr George F. Kunz, a member of the Society. On one side it bears the seal of the Society, and on the reverse the following inscription: "The Hubbard Medal, awarded by the National Geographic Society to Robert E. Peary for arctic exploration. Farthest north, 87° 6'. December 15, 1906." A blue sapphire star, from Montana, marks the point of farthest north attained by Mr Peary.

The members were received in the parlors of the New Willard by the President of the National Geographic Society and Mrs Moore, Commander Peary (illness prevented Mrs Peary from being present), and the Secretary of the Navy, from 7 to 7.30, after which the company adjourned to the banquet hall. After an invocation by Dr Edward Everett Hale, Chaplain of the U. S. Senate, the guests took the places assigned to them at the twelve long tables, which had been decorated by Small & Sons. The U. S. Marine Band played throughout the dinner. President Roosevelt arrived after the dinner had been served and while Dr Cook was speaking.

The first toast of the evening was drunk to the President of the United States, and while the guests were standing the toastmaster, President Moore, asked all to join in a moment of silent memorial to the first President of the Society, Gardiner Greene Hubbard.

In his introductory remarks President Moore called attention to the fact that the National Geographic Society numbered in its ranks the best men of the best nations of the world. He declared that there were present at the dinner some of the men who had achieved the greatest discoveries in science, the greatest lawmakers, the highest representatives of the church. He said that from small beginnings the Society had grown until it now numbered 18,000 members, and he added: "We are not modest in our ambitions: we wish to know all about the earth, and the waters under the

earth, and the heavens above the earth." Briefly, he recapitulated some of the triumphs achieved by members of the Society, explorations in the South Pacific, in darkest Africa, and the farthest north. He recalled that in the year 1882 the farthermost point in the arctic regions was reached by an officer and founder of the National Geographic Society—General A. W. Greely, who held the much-coveted prize for fourteen years, when it was wrested from him by that hardy Norseman, Nansen. He in turn was eclipsed by the Duke of Abruzzi, and it had remained for Commander Peary, of America, to rob Italy of her well-won honors. As the representative of the Duke of Abruzzi's country was present, he would ask him to respond to the toast: "Congratulations from Italy on America's farthest north."

BY THE ITALIAN AMBASSADOR, BARON MAYOR DE PLANCHES

Mr President, Ladies and Gentlemen:

I beg to express, before all, my best thanks to the National Geographic Society for the kind invitation I received from it to attend this solemn assembly.

Solemn, not only in the etymological acceptance of the word—*sole in anno*—but in its largest extent, because you are here gathered not only for your annual banquet, but to celebrate a great deed and a great man.

An Italian, a son of our ancient and illustrious royal family, a prince who is at the same time a true seaman, held for several years the record of the farthest latitude in the arctic regions. This record is now yours, Commander Peary. With what energy, with what almost superhuman endurance, you obtained it, is world-wide known, and I am sure that the Duke of Abruzzi, so high-minded as he is, applauds the triumph of his glorious emulator. Nobody was more worthy of success than you, Commander Peary—you, an American, you a veteran, a young veteran, indeed, of the war against the mysterious powers that jealously defend the approach of the Pole.

In the fields of science, there is no place for low feelings; in the competition for the conquest of the globe, there is no sentiment of envy. All work for humanity. I am therefore happy to tribute, on behalf of the Italians, to you, Commander Peary, to your courageous and faithful followers, to your intrepid companion, Mrs Diebitsch Peary, the most sincere expression of our deep, warm, and heartfelt admiration.

COMMANDER PEARY'S ACKNOWLEDGMENT TO THE ITALIAN AMBASSADOR

Mr Ambassador, I deeply value your kindly words. Coming from the illustrious representative of the country which claims Abruzzi and Cagni, they are doubly prized. The fact that such names as Abruzzi, Cagni, Nansen, Greely, and Peary are indelibly inscribed upon the white disk close to the Pole, shows conclusively, if anything were needed to show it, that these efforts to solve the northern mystery represent the biggest, cleanest, most manly example of friendly international rivalry that exists.

It is a magnificent galaxy of flags that has been planted around the Pole, and when eventually some one of them shall reach the Pole itself, it will add to its own luster without in any way detracting from the luster of the others or leaving any sense of injury or humiliation in its wake.

The fact that years of experience have enabled me to plant the Stars and Stripes nearer the Pole than the colors of Italy in no way lessens D'Abruzzi's honors or his magnificent feat. It causes no surprise on our part when Norsemen, Britons, and Yankees seek the rigors of the north; but when a son of the south, of sunny Italy, strikes swiftest and deepest into the mystery of the frozen north, we recognize that it is the hand, heart, and head that do things in this world, regardless of race, or climate, or other conditions.

Abruzzi has always had my warmest admiration, not only for his own personal attributes and the fact that what

he sets his hand to do he does, whether it be in the frozen north, or in the heart of Africa, but because he presents, as I remarked on the occasion of the award to him of the great gold medal of the American Geographical Society in New York, such a shining example to the gilded youth of unbounded means in this and other countries who have no higher ambition than to possess the fastest automobile or to win the blue ribbon at some fleeting horse or dog show, when they might, like Abruzzi, devote their time, their abilities, and their money to adding to the sum of human knowledge.

One thing have I envied him, and that is the power that when he sees something in the world of exploration which he feels ought to be done he can put his hands in his pocket and go and do it, without wasting the greater portion of his gray matter in raising the sinews of war, and thus being compelled to enter upon the work almost exhausted in mind and body. I trust he may long continue to win new honors for his country, and should he or any other in the near future better the record or reach the Pole itself, our hands shall be extended in warmest congratulation to one whom we shall know is a man.

ANNOUNCEMENT BY PRESIDENT MOORE OF THE ELECTION OF GEORGE DEWEY, ROALD AMUNDSEN, AND MORRIS K. JESUP AS HONORARY MEMBERS

The National Geographic Society has for honorary members President Roosevelt, Nansen, the Duke of Abruzzi, Grover Cleveland, Robert E. Peary, and Prince Roland Bonaparte, the latter dividing the honor of relationship with one of the distinguished members of the Cabinet of the United States. The Board of Managers of the National Geographic Society has recently elected as honorary members Admiral George Dewey, who has had something to do with the geography of the world; Roald Amundsen, who has recently completed the Northwest Passage, and Morris K. Jesup, President of the Peary Arctic Club.

From Mr Morris K. Jesup, the President of the Peary Arctic Club who has largely borne the expense, with some few of his friends of the Arctic Club, of sending this magnificent expedition, commanded by our august explorer, Commander Peary, we have just received the following telegram:

"*To the National Geographic Society, Washington, D. C.:*

"Very much regret being unable to be present this evening at your banquet for Peary. He is worthy and entitled to all the honor that his country can bestow.

"MORRIS K. JESUP."

The next toast is the "United States Navy." What man is there whose breast does not swell with pride when he thinks of the achievements of the United States Navy—from the flag that Paul Jones first unfurled to the fighting breezes until we come down to our own contemporary men, Dewey, Sampson, and our own beloved Schley! The navy has had much to do besides the manning of ships of war. It has explored the ocean depths, it has marked the boundary lines of islands, and it has sent great expeditions into the north. So our navy has done much that we can be proud of, and it is highly appropriate that a toast should be given tonight to the United States Navy; and who is more worthy to respond to that toast, and who better illustrates in his own light and his own achievements the best that there is in American citizenship than Charles J. Bonaparte.

THE UNITED STATES NAVY, BY HON. CHARLES J. BONAPARTE

Mr President, Ladies and Gentlemen:

Before speaking of the toast to which I am asked to respond, I wish to express our gratitude to our friend and special guest this evening, not merely for not having found, but having come pretty near finding the Pole, but also for having solved in his speech this evening one of those problems which at present are perplexing the souls of the more thoughtful among the American people. We want to know what we shall do with our

multi-millionaires. I was in a great deal of doubt on that subject myself until I heard the speech to which we last listened. Now the solution has been cleared. We may send the young ones to the North Pole and the old ones can pay for getting there.

Now, ladies and gentlemen, I have been asked to respond to the toast "The American Navy." I hope that many of you will often attend many of the banquets of the National Geographic Society. It will be my very undeserved good fortune if I am so happy as to be with you at more than one of them, but surely this is the only chance that I will ever have to answer to this toast, for the navy is about to get rid of the least worthy element in it; and it is only by taking advantage of the few hours of very undeserved honor that remains to me that I am qualified for answering, as I am about to answer this evening.*

The navy in rendering the service it has always rendered to our country has aided in many things. Solving these mysteries of the northern wilderness to which our attention has already been called, however important in itself, is after all only a part of the duty which the navy has to render, and only a part of the claim which it has on the gratitude and admiration of its countrymen; for I may say with a good grace, since no one will think that I am entitled to any of the credit which I claim for it, that it has always been ready under all circumstances and at all times to do its duty; and what more can any one claim?

I am about to leave the navy, and I therefore feel that I may take advantage of your ill-judged kindness in calling upon me to deliver a sort of funeral oration of the involuntary suicide which I am about to make. I will endeavor to praise only what is worthy of praise, and to call your attention not to the unimportant matter of who signs the navy's mail, but to the really important matter of whether this country, of which you are the worthy representatives, gives to that branch of its public service the support in sympathy, in appreciation, and money which it deserves from any country which has sense enough to know when it has a good thing and ought to keep it.

It is difficult for a Secretary of the Navy who has not outgrown all desire to have his country show itself worthy of the good fortune that a kind Providence has given it—it is difficult for such a Secretary to avoid feeling some unphilosophic indignation at the want of appreciation of the immense value of this great factor of our nation's honor and safety and the peace of the world which I see every day in the exponents of public opinion around us. I, however, do not propose, in the funeral oration to which I have already referred, to dwell on the shortcomings of the world in general and America in particular, in its failure to fully appreciate the merits and sacrifice of its seamen, but I wish to ask of you all to use the legitimate influence which each one of you has, and which all of you have so much in this community, to enable your fellow-citizens to understand, as I feel sure you understand, how important it is to the dignity, the usefulness to mankind, and the self-respect of the American people that it should treat its navy as that navy deserves to be treated and as the interests of the country demand.

In the first place, let us all understand that by having this safeguard of our peace and independence and needed national existence we are spared enormous burdens borne by less favored nations, and of which we cannot even appreciate the weight, so little have we reason to fear. In the next place, let us understand that these men, who are ready to serve us in all contingencies, and amid all dangers, and at the cost of all sacrifice, deserve to be regarded by their fellow-countrymen as worthy at least of gratitude and respect.

I saw the other day in one of our newspapers a comment, and I may say criti-

* The speaker became Attorney General of the United States Decmeber 17, 1906.

cism, on my annual report, in that I showed too much warmth at the discrimination, the insulting discrimination, shown in certain parts of this country against the uniform of our sailors. Now, ladies and gentlemen, let me detain you two or three minutes by enabling you, as intelligent and public-spirited men and women, to understand what is meant by the discussion on that subject, for if you understand it, that is all that any one can ask. Our ships are manned in great majority by young men from the farms and homes of our country, men between eighteen and twenty-five years—boys, most of us would be disposed to call them—who are not the old nomadic cosmopolitan sailors of former days, but are men who respect themselves, and who desire the respect of others, and who look forward—I do not deny that there are black sheep in every lot, and some in these—to becoming useful and respected members of society. These boys are away, isolated from all amusements, leading a monotonous life on ships for months at a time, and when they return to port and are given the opportunity to do what every young thing wants to do, kick up its heels, and have the inclination which it is perfectly natural and perfectly laudable of men of their age and surroundings to have, to be rewarded for this long period of monotonous isolation by a certain amount of amusement and distraction—these men have, in too many parts of our country, all reputable sources of amusement and relaxation closed to them for no other reason than that they are clothed in the garments which show that they are serving their country. And what are the consequences? That, excluded from the places where they might be amused innocently and creditably, they are driven into haunts of vice, with the consequences that would naturally follow. It is not a trifling matter; it is a matter of which any community which endures it has every reason to be ashamed; and when the Secretary of the Navy, in company with the President of the United States and with all prominent officers of the service, feels and expresses indignation at such treatment for such men, for such service, I say that is no ground for observation that he grows hot over trifles.

Again, I ask of you to use your influence, the influence which each one of you has, in such circles as he or she frequents, to make the people of the United States understand how grave a thing it is to hamper the development of this branch of the national defense, when you must know that in its keeping is the safety of our country from perils too serious to be lightly mentioned, and yet which are often inexcusably forgotten.

THE TOASTMASTER

Watts gave to us the steam-engine, Fulton the steamboat, Morse the telegraph, and finally Bell the telephone. Probably no man has done more to link humanity together, to make us all one kin, than he who has solved the great problem of sending the beautiful modulations of the human voice over a metallic circuit. Our Society was honored by having that man for its President, and if I could express and enforce my own opinion and that of the members of the National Geographic Society, he would still be the President of the National Geographic Society. We love him, and I am going to introduce him now to say a few words and to have him introduce Dr Cook, not because we need him to wake things up, but I want you to see him, Alexander Graham Bell.

REMARKS BY DR ALEXANDER GRAHAM BELL

Mr President, Ladies and Gentlemen:

I am indeed proud of this gathering of the members of the National Geographic Society, and to think that I once had the honor of being your President. I remember well when the mantle of your first President, Mr Hubbard, fell on my shoulders, and we looked at this little seed that he helped plant. Could we ever suppose it could grow into the great national organization that we have today? That little seed! And yet I can still re-

member when we congratulated ourselves upon a thousand members; but today we number eighteen thousand members; this little seed has grown into a tree and covers the whole world; wherever Americans are, there we find members of the National Geographic Society.

But I have been asked to say a few words about a man who must be known by name, at least, to all of us, Dr Frederick A. Cook, President of the Explorers' Club, New York. We have had with us, and are glad to welcome, Commander Peary, of the Arctic regions, but in Dr Cook we have one of the few Americans, if not the only American, who has explored both extremes of the world, the Arctic and the Antarctic regions. And now he has been to the top of the American continent, and therefore to the top of the world, and tonight I hope Dr Frederick Cook will tell us something about Mount McKinley.

THE TOP OF NORTH AMERICA, BY DR F. A. COOK

Mr Chairman, Ladies and Gentlemen:

I would prefer to tell you tonight of the splendid achievement of Commander Peary and of the noble character of the man who has succeeded in pushing human endeavor to the utmost limit of endurance, all with the unselfish motive of carrying the honor and the flag of his country to the farthest north, but your chairman has put me to the task of getting to the top of our continent.

In the conquest of Mount McKinley success was mostly due to our use of the working equipment of polar explorers, and among polar explorers Commander Peary has worked hardest to reduce the outfit to its utmost simplicity. Thus indirectly to Commander Peary should fall a part of the honor of scaling the arctic slopes of our greatest mountain.

Mount McKinley is in mid-Alaska. It is 20,300 feet high. Its summit pierces the frigid blue one thousand feet above any other mountain on the North American continent. It is, then, the top of our continent and the most arctic of the big mountains of the world. The country to the east was entirely unknown, and the country to the west but roughly outlined. A venture to ascend this mountain must therefore assume the responsibilities of an exploring enterprise and be prepared for all kinds of difficulties.

Three years ago, as Commander Peary was preparing for his assault upon the North Pole, I organized an expedition to ascend Mount McKinley from the west. In this we failed, but we carried a line of exploration through and around the range.

Last spring I organized another expedition upon a similar general plan. My chief companions were Prof. H. C. Parker, Russell W. Porter, Belmore H. Browne, and Edward Barrille. We took twenty pack horses from Seattle for our difficult cross-country transportation, and for the river we built a powerful motor boat.

We reached Cook Inlet early in June. During June and July we forded and swam icy streams, pushed through thick underbrush, and over gloomy marshes, only to find that the part of the mountain which we finally reached was impossible for an ascent.

A good deal of pioneer work was done at this time, but the opportunity to make an attempt to climb did not present itself until early in September, after all hope of mountaineering had been abandoned. The launch was pushed up the Susetna and the Chulitna rivers to the east of Mount McKinley. From here with two men I aimed to explore a route for a future ascent.

We left the boat and with our camp equipment and instruments in rush sacks we started for the mountain. In an air line we were forty miles from the summit, and from our position we noted three possible lines of ascent. A large glacier which we had previously discovered offered us here a highway through the giant foothills. In three days we were against the main slope of the great mountain; but here our difficulties began.

I was fortunate enough to have two

loyal supporters, Barrille and Dokkin. Barrille was chosen as my sole companion for the upper work, while Dokkin was instructed to place a line of caches along the glacier. It was now September 11, winter was advancing rapidly; snow covered all the foothills down to 2,000 feet, and frosty storms must be expected. We had explored the first glacier, which was our main mission at this time, but the route to the summit was as uncertain and seemingly impossible as ever, but on the morrow we resolved to make a vigorous trial.

Our silk tent was pitched on the glacial ice. We ate pemmican, drank tea, and put down hard bread while a strong wind was rushing down from the gulches of the big mountain. Huge black clouds were so low that we could almost touch them, and through them rushed soul-stirring avalanches; great boulders of rock and ice, followed by a hiss, a gust of wind, tons of snow, explosive noises, and the entire range quivered as from an earthquake. The noise of the cracking glaciers increased with the advancing night, but the avalanches decreased, the clouds brightened, and at dawn the giant slopes of Mount McKinley loomed up in the blue twilight, sharp, steep, pointing heavenward so far up—so inconceivably high that it took our breath as we tried to estimate the task of climbing. I never felt so small and the sky never seemed so distant. We were shivering as we melted ice for tea and ate pemmican, but as the sun burst over the icy spires, and a million reflecting surfaces threw piercing rays from slope to slope we warmed up to our enterprise.

The bright blaze of this sunburst remained with us long enough to get started into a maze of blue crags and gloomy granite cliffs. We were aiming to get to the north arête for our day's task. Cloud after cloud drifted on us, and each cloud was preceded and followed by a brief blast of icy wind. Hour after hour we dug our feet and hands into the snow in desperate effort to get from crevass to crevass, from grottos to cliffs, always gaining a little altitude and rising farther and farther into cloudland, with its awful cold and stormy agitation. The day was a long one. Without food or drink, with little rest or relief from awe-inspiring excitement, we ascended until about 7 p. m. Here, on a cornice, we built a snow house and within we found rest and comfort, amid cloud and storms.

The day after the sun again broke through the clouds of snow for a few brief moments. We noted the bright, snowy slopes of Mount McKinley with less fear and more courage. We were at 12,000 feet, and but one difficult cliff barred the way to the summit, and we resolved at all hazards to find a way around this barrier. The way proved, however, a long one. For two days we chopped steps, dragged each other over dangerous ice cornices and slippery rocks, and as we had conquered this impediment we rose out of the cloud world of storm into a region of silence and serenity. Above were the easy slopes of the top; below, a chaos of cliff and spire, a maze of crags and grottos, with clouds wildly sweeping the slopes.

We had now risen to nearly 15,000 feet before we could assure ourselves that an ascent along our chosen route was possible. We were chilled to the marrow and our forces were about exhausted. Would we push on to the summit or return? We agreed to push to the summit. It was our sixth day on the climb, and we estimated that another long day would place us on the summit. But now our legs were heavy, our packs like lead; we were heaving for breath, with icicles forming on our mustaches and hearts thumping like a gas engine in trouble. Two thousand feet was all we could put to our credit on the seventh day; but, starting early in the morning of the 16th of September, we began the last weary climb. It was hard to lift one foot above another; but the slope was easy, and with much forced effort we made a few hundred paces, leaned over our ice axes, puffed a few minutes, and then went

farther. We dropped on a snow slope a few hundred feet below the summit and tried to rest, while we gasped for breath; but the piercing air chilled us; and so, with knees bent, and back bent, and chests laboring like bellows, we digged one foot after another over the big blocks of granite at the top. The summit at last—the top of the continent. Our North Pole had been reached. To an ice axe the flag was attached, and Barrille stood on the brink, as near heaven as he ever expects to get and live. We had been eight days in ascending, but we remained only twenty minutes. It would, however, take me several hours to tell you what we saw. This I will reserve for a future occasion.

THE TOASTMASTER

The National Geographic Society is honored by the presence of the Chief Executive of the United States.

The Board of Managers of the National Geographic Society, representing, as was said earlier in the evening, eighteen thousand members, widely scattered over the civilized world, have by unanimous vote ordered that a handsome gold medal be presented to Commander Robert E. Peary for distinguished service in exploration, and for having reached the farthest north, 87 degrees and 6 minutes. Because of the many distinguished achievements that stand to his own personal credit, to add honor to that medal, we are proud of having it presented by the President of the United States with his own hands.

ADDRESS BY PRESIDENT ROOSEVELT

Mr Chairman, Ladies and Gentlemen:

I count myself fortunate in having been asked to be present this evening at such a gathering and on behalf of such a society, to pay a tribute of honor to an American who emphatically deserves well of the commonwealth. (Applause.) Civilized people usually live under conditions of life so easy that there is a certain tendency to atrophy of the hardier virtues. And it is a relief to pay signal honor to a man who by his achievements makes it evident that in some of the race, at least, there has been no loss of hardier virtues.

I said some loss of the hardier virtues. We will do well to recollect that the very word virtue, in itself, originally signifies courage and hardihood. When the Roman spoke of virtue he meant that sum of qualities that we characterize as manliness.

I emphatically believe in peace and all the kindred virtues. (Applause.) But I think that they are only worth having if they come as a consequence of possessing the combined virtues of courage and hardihood. So I feel that in an age which naturally and properly excels, as it should excel, in the milder and softer qualities, there is need that we should not forget that in the last analysis the safe basis of a successful national character must rest upon the great fighting virtues, and those great fighting virtues can be shown quite as well in peace as in war.

They can be shown in the work of the philanthropist, in the work of the scientist, and, most emphatically of all, in the work of the explorer, who faces and overcomes perils and hardships which the average soldier never in his life knows. In war, after all, it is only the man at the very head who is ever lonely. All the others, from the subordinate generals down through the privates, are cheered and sustained by the sense of companionship and by the sense of divided responsibility.

You (turning to Commander Peary), the man whom we join to honor tonight—you, who for months in and months out, year in and year out, had to face perils and overcome the greatest risks and difficulties, with resting on your shoulders the undivided responsibility which meant life or death to you and your followers—you had to show in addition what the modern commander with his great responsibility does not have to show—you had to show all the moral qualities in war, together with other qualities. You did a great deed, a

deed that counted for all mankind, a deed which reacted credit upon you and upon your country, and on behalf of those present, and speaking also for the millions of your countrymen, I take pleasure in handing you this Hubbard Medal, and in welcoming you home from the great feat which you have performed, Commander Peary. (Prolonged applause.)

RESPONSE TO THE PRESIDENT BY COMMANDER PEARY

President Roosevelt:

In behalf of the Peary Arctic Club and its president, Morris K. Jesup, I beg to express our deep appreciation of the great honor conferred by the National Geographic Society in this award of its gold medal, and the double honor of receiving this medal from the hand of President Roosevelt.

Your continued interest, Mr President, and permission to name the club's ship after you, has been most deeply valued by the club and your name has proved a powerful talisman. Could I have foreseen this occasion it would have lightened many dark hours; but I will frankly say that it would not, for it could not, have increased my efforts.

The true explorer does his work not for any hope of rewards or honor, but because the thing he has set himself to do is a part of his very being, and must be accomplished for the sake of accomplishment, and he counts lightly hardships, risks, obstacles, if only they do not bar him from his goal.

To me the final and complete solution of the Polar mystery which has engaged the best thought and interest of the best men of the most vigorous and enlightened nations of the world for more than three centuries, and today quickens the pulse of every man or woman whose veins hold red blood, is the thing which should be done for the honor and credit of this country, the thing which it is intended that I should do, and the thing that I must do.

Assertions that the Pole cannot be reached; that the result of the last expedition is to show the unavailability of dogs and sledges and of the route followed; that there are better methods for attaining the Pole than by dogs and sledges; that the discovery of the Pole is not a matter of any value or interest, are equally erroneous.

The result of the last expedition of the Peary Arctic Club has been to simplify the attainment of the Pole fifty per cent, and to accentuate the fact that man and Eskimo dog are the only two mechanisms capable of meeting all the varying contingencies of Arctic work and that the American route to the Pole and the methods and equipment which have been brought to a high state of perfection are the best for attaining that object.

Had the past winter been a normal season in the arctic region and not, as it was, a particularly open one throughout the Northern Hemisphere, I should have won the prize. And even if I had known before leaving the land what actual conditions were to the northward, as I know now, I could have so modified my route and my disposition of sledges that I could have reached the Pole in spite of the open season.

Another expedition following in my steps and profiting by my experience can not only attain the Pole: it can secure the remaining principal desiderata in the arctic regions, namely, a line of deep-sea soundings through the central Polar Ocean, and the delineation of the unknown gap in the northeast coast line of Greenland from Cape Morris Jesup to Cape Bismarck. And this work can be done in a single season.

As regards the belief expressed by some, that the attainment of the North Pole possesses no value or interest, let me say that should an American first of all men place the Stars and Stripes at that coveted spot, there is not an American citizen at home or abroad, and there are millions of us, but what would feel a little better and a little prouder of being an American; and just that added increment of pride and patriotism to mil-

lions would of itself be ten times the value of all the cost of attaining the Pole.

President Roosevelt, for nearly four centuries the world dreamed of the union of the Atlantic and the Pacific. You have planted the Stars and Stripes at Panama and insured the realization of that dream. For over three centuries the world has dreamed of solving the mystery of the north.

Tonight the Stars and Stripes stand nearest to that mystery, pointing and beckoning. God willing, I hope that your administration may yet see those Stars and Stripes planted at the Pole itself. For between these two great logical cosmic boundaries, Panama to the south and the North Pole to the north, lies the heritage and the future of that giant whose destinies you guide today, the United States of America.

The committee of arrangements for the dinner consisted of

Gilbert H. Grosvenor, Chairman; O. P. Austin, Alexander Graham Bell, Charles J. Bell, W. J. Boardman, Colby M. Chester, F. V. Coville, William Crozier, Henry F. Blount, William E. Curtis, George Dewey, John Joy Edson, David Fairchild, Melville W. Fuller, Henry Gannett, J. Howard Gore, John W. Foster, Edward Everett Hale, A. J. Henry, Arnold Hague, John B. Henderson, Jr., Rudolph Kauffmann, Martin A. Knapp, C. Hart Merriam, Willis L. Moore, Simon Newcomb, Theodore W. Noyes, Gifford Pinchot, Marvin F. Scaife, Miss Eliza R. Scidmore, O. H. Tittmann, John M. Wilson.

MEMBERS AND GUESTS PRESENT

Commander Robert E. Peary, U. S. Navy
The Secretary of the Navy, Hon. Charles J. Bonaparte
The Italian Ambassador
The President of the National Geographic Society and Mrs Willis L. Moore
The Japanese Ambassador
The Secretary of Agriculture
The Minister of Bolivia and Madame Calderon
The Minister of Switzerland
Representative and Mrs Kittredge Haskins, of Vermont
Dr Frederick A. Cook
Mr Emory R. Johnson, President Geographical Society of Philadelphia, and Mrs Johnson
Mrs Hobson
Commander and Mrs Key
The counselor of the Japanese Embassy and Madame Miyaoka
The Minister of Colombia and Madame Cortes
The Minister of Norway and Madame Hauge
The Minister of Ecuador and Madame Carbo
The Chargé d'Affaires of Spain
Mr Frederick Courtland Penfield, formerly Minister to Egypt
Mrs George Kennan
Mr and Mrs Tilden
Dr Theodore LeBoutillier, Secretary of Geographical Society of Philadelphia
Dr Anita Newcomb McGee
Judge Martin A. Knapp, President Interstate Commerce Commission
Judge Clark, of the Interstate Commerce Commission
Representative Grosvenor, of Ohio, and Mrs Grosvenor
General George M. Sternberg
Mr and Mrs Herbert Wadsworth
Mr and Mrs Hennen Jennings
The Bishop of Washington
Mrs James W. Pinchot
Senator Hopkins, of Illinois, and Mrs Hopkins
Mr and Mrs Shainwald, of New York city
Representative Dalzell, of Pennsylvania, and Mrs Dalzell
Monsignor O'Connell, President of Catholic University of America
Mr and Mrs Theodore W. Noyes
Mr Archibald Hopkins
Senator Warren, of Wyoming
Dr and Mrs Alexander Graham Bell
Mr Edward Everett Hale
Prof. Simon Newcomb
Admiral Bradford
Mr Nicholas Luquer
Mr W. C. Whitemore
Mr James Lowndes
Mr W. R. Tuckerman
Mr Nathaniel Wilson
Mr Byron Andrews
Mr W. A. DeCaindry
Gen. John O'Connell
Representative Lamar, of Florida, and Mrs Lamar
Representative Scott, of Kansas
Admiral Winfield Scott Schley and Mrs Schley
Mr W. J. Boardman
Mr John A. Kasson
Dr Z. T. Sowers
Commissioner H. L. West
Miss Hale
Judge Thomas H. Anderson and Mrs Anderson

Rev. J. A. Aspinwall
Dr and Mrs Teunis S. Hamlin
Mr Hillary A. Herbert, ex-Secretary of Navy
Judge Ambler
Representative Richard Bartholdt, of Missouri
Mr Daniel C. Gilman, formerly President Carnegie Institution, and Mrs Gilman
Mr Hanihara, Second Secretary of Japanese Embassy
Mr Crosby S. Noyes
Mr William B. Howland
Mr B. H. Warner
Mr Robert P. Porter
Judge Job Barnard and Mrs Barnard
Mr Herbert L. Bridgman, Secretary Peary Arctic Club
Mr Jesse E. Wilson, Assistant Secretary of Interior
Mr and Mrs C. H. Ackert
Surgeon General Wyman, of the Marine Hospital Service
Dr W. A. White, Superintendent Government Hospital for the Insane
Senator Clarence D. Clark, of Wyoming, and Mrs Clark
Representative Lacey, of Iowa
Hon. George Shiras, Third
Lieutenant General Nelson A. Miles, U. S. Army
Mrs Joseph Kuhn
Senator Perkins, of California
Mr Gardner F. Williams
Dr George M. Kober
Mr A. Maurice Low
Mr Henry C. Perkins
Representative Mann, of Illinois, and Mrs Mann
Hon. Charles D. Walcott, Director U. S. Geological Survey, and Mrs. Walcott
Mr and Mrs E. G. Walker
Miss Laura Bell, of Philadelphia
Mr and Mrs Anthony Fiala
Miss Emily Bell
Mr Charles L. Marlatt
Mr and Mrs Stuyvesant Pillot, of New York
Representative Burton, of Ohio
Mrs Sweat
Mr and Mrs Henry S. Kerr, of New York
Miss Eliza R. Scidmore
Dr and Mrs Hamilton Wright
Mr and Mrs Arthur Dunn
Mr W. R. Hunn, of Philadelphia
Mr George Wood, of Philadelphia
Mr Gilbert H. Grosvenor, editor of the NATIONAL GEOGRAPHIC MAGAZINE, and Mrs Grosvenor
Mr and Mrs Charles Denby
Dr and Mrs George F. Becker
Mr W. S. Irwin, managing editor *McClure's Magazine*
Miss Perkins
Representative Perkins, of California
Mrs Hatton
Mr Gifford Pinchot, Forester of U. S. Forest Service
Mr Hector Fuller
Mr George L. Raymond
Miss Aileen Bell
Dr J. H. Bryan
Miss Bryan
Mr and Mrs D. C. Phillips
Mr and Mrs F. D. McKenney
Mr W. A. Mearns
Dr J. C. Simpson
Mr F. A. Richardson
Mr Frank Sutton
Senator McCreary, of Kentucky
Mrs Wynne
Colonel Casey, U. S. Army, and Mrs Casey
Mr and Mrs Marvin F. Scaife
Prof. Joseph A. Holmes
Mr and Mrs C. A. Richardson
Mr and Mrs A. B. Browne
Mr and Mrs Hutchinson
Hon. Charles Henry Butler
Mr and Mrs Alpheus H. Snow
Hon. O. H. Tittmann, Superintendent U. S. Coast and Geodetic Survey
Mr and Mrs Edgar C. Snyder
Mr Gilson Gardner
Mr Piller
Mr Thompson
Mr John Holmes Magruder
General Shallenberger
Mr and Mrs George H. Judd
Dr and Mrs L. A. Bauer
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Senator Heyburn, of Idaho, and Mrs Heyburn
Mr James S. Henry
Mr A. F. Emery
Mr Odell L. Whipple
Mr Arthur G. Plant
Mr Frank B. Lord
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Mr and Mrs Futton
Rev. Thomas D. Clark
Miss McCerey
Miss Gena Russell Harding
Rev. and Mrs Ernest Smith
Representative Graff, of Illinois, and Mrs Graff
Rear Admiral Colby M. Chester, U. S. Navy
Mr and Mrs George W. Rouzer
Mr A. A. Adee, Second Assistant Secretary of State
Mr R. L. Fearn
Major and Mrs Reynolds Landis
Mr Wm. B. Thompson
Mrs McCourtney
Dr Muncaster
Mr and Mrs Howard S. Nyman
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Representative Cox, of Tennessee
Senator Burkett, of Nebraska, and Mrs Burkett
Mr A. J. Stofer
Mr Louis Garthe

Dr Ralph Jenkins
Mr John Philip Sousa
Mr E. W. Foster
Mr and Mrs W. H. Baldwin
Mr H. C. Gauss
Dr and Mrs David T. Day
Representative Ransdell, of Louisiana
Prof. and Mrs J. Howard Gore
Mrs M. B. Tulloch
Mr Henry V. Tulloch
Mr Arthur C. Johnson
Mr J. A. Breckons
Mrs W. A. H. Church
Mr Edward S. Jones
Mr Melville Church
Mr W. W. Andrews
Mr Ernest H. Merrick
Mr A. E. Bowers
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Representative Burleson, of Texas, and Mrs Burleson
Mr and Mrs David Fairchild
Mr John Ross Martin
Mr Frederick E. Mann
Mr Ernest Janson
Mr and Mrs Joseph Crawford
Miss Rollins
Dr and Mrs S. F. Emmons
Miss Pruyn
Dr and Mrs Alberton S. Cushman
Representative Lamb, of Virginia
Mr Gardiner Bell
Miss Pillot
Rev. David H. Buel
Mr Charles J. Bell, President American Security and Trust Co., and Mrs Bell
Mr W. W. Jermyn
Mr B. F. Johnson
Mr and Mrs W. H. Seamon
Miss C. C. Barnam
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Rev. S. H. Greene
Mr Bourne
Mr and Mrs Kern
Miss Kern
Dr F. E. Hoskins
Mr and Mrs William E. Curtis
Mr and Mrs Goehring
Mr Milo A. Shand
Mr Arnold
Mr and Mrs H. E. Williams
Mr and Mrs E. B. Stocking
Colonel and Mrs Rutherford
Miss Farrell
Mr and Mrs George E. Roberts
Senator Long, of Kansas, and Mrs Long
Mr Henry F. Blount, Vice-President American Security and Trust Co., and Mrs Blount
Mr R. S. Woodward, Jr.
Miss Carbo
Mr E. S. Barlow
Miss Gheen
Admiral and Mrs Prindle, U. S. Navy
Mr and Mrs Andrew B. Graham
Mr John B. Sleman, Sr.
Mr E. Quincy Smith
Mr John B. Sleman, Jr.
Miss Austin
Mr M. I. Weller
Senator Gallinger, of New Hampshire, and Mrs Gallinger
Mr Reuel Small
Mr Frank B. Stetson
Mr Charles S. Bradley
Mr Fred. G. Clapp
Admiral and Mrs Gheen, U. S. Navy
Mr and Mrs G. R. Putnam
Mr William Bowie
Col. and Mrs Robinson
Gen. James A. Buchanan
Mr and Mrs C. E. Grundsky
Hon. O. P. Austin, Chief Bureau of Statistics, and Mrs Austin
Mr F. C. Billard
Capt. W. V. Jacobs
Dr C. L. Billard
Miss Hendley
Mr Hendley
Mr Herndon Morsell
Mr A. B. Casselman
Mr F. W. Booth
Prof. and Mrs Humphreys, of Mount Weather Observatory
Mrs Breaux
Mr and Mrs Otto J. Luebkert
Ex-Senator and Mrs Thurston, of Nebraska
Mr Busby
Dr and Mrs George B. Welch
Mr J. T. Granger
Rev. and Mrs W. R. Turner
Mr and Mrs F. B. Eichelberger
General Ellis Spear
Mr Mattingly
Representative Brooks, of Colorado, and Mrs Brooks
Senator Pyles, of Washington
Mr John Joy Edson, President Washington Loan and Trust Company, and Mrs Edson
Mr Waernicke
Mr A. H. Chase
Mr and Mrs Bradbury
Mrs G. V. B. Moore
Mr Walter C. Thomas
Mr and Mrs Mesney
Mr and Mrs Buckey
Mr and Mrs Van Wickle
Mr Dennis
Mr S. I. Kimball, Superintendent of the Life Saving Service
Mr W. G. Dennis
Mr John W. Echols
Mr Edward R. Wood
Mr and Mrs Denney
Mr W. R. Smith
Mrs Eliza T. Ward
Mrs T. H. McKee
Mr James Peniman
Mr Charles P. Neill, Commissioner of Labor, and Mrs Neill
Mr and Mrs F. V. Coville
Mr John Oliver LaGorce

AN AWAKENED CONTINENT TO THE SOUTH OF US*

BY HON. ELIHU ROOT, SECRETARY OF STATE

A LITTLE less than three centuries of colonial and national life have brought the people inhabiting the United States, by a process of evolution, natural and with the existing forces inevitable, to a point of distinct and radical change in their economic relations to the rest of mankind.

During the period now past the energy of our people, directed by the formative power created in our early population by heredity, by environment, by the struggle for existence, by individual independence, and by free institutions, has been devoted to the internal development of our own country. The surplus wealth produced by our labors has been applied immediately to reproduction in our own land. We have been cutting down forests and breaking virgin soil and fencing prairies and opening mines of coal and iron and copper and silver and gold, and building roads and canals and railroads and telegraph lines and cars and locomotives and mills and furnaces and school-houses and colleges and libraries and hospitals and asylums and public buildings and storehouses and shops and homes. We have been drawing on the resources of the world in capital and in labor to aid us in our work. We have gathered strength from every rich and powerful nation and expended it upon these home undertakings; into them we have poured hundreds of millions of money attracted from the investors of Europe. We have been always a debtor nation, borrowing from the rest of the world, drawing all possible energy towards us and concentrating it with our own energy upon our own enterprises. The engrossing pursuit of our own opportunities has excluded from our consideration and interest the enterprises and the possibilities of the outside world. Invention, discovery, the progress of science, capacity for organization, the enormous increase in the productive power of mankind, have accelerated our progress and have brought us to a result of development in every branch of internal industrial activity marvelous and unprecedented in the history of the world.

WE HAVE A NEW ROLE TO PLAY

Since the first election of President McKinley the people of the United States have for the first time accumulated a surplus of capital beyond the requirements of internal development. That surplus is increasing with extraordinary rapidity. We have paid our debts to Europe and have become a creditor instead of a debtor nation; we have faced about; we have left the ranks of the borrowing nations and have entered the ranks of the investing nations. Our surplus energy is beginning to look beyond our own borders, throughout the world, to find opportunity for the profitable use of our surplus capital, foreign markets for our manufactures, foreign mines to be developed, foreign bridges and railroads and public works to be built, foreign rivers to be turned into electric power and light. As in their several ways England and France and Germany have stood, so we in our own way are beginning to stand and must continue to stand towards the industrial enterprise of the world.

That we are not beginning our new role feebly is indicated by $1,518,561,666 of exports in the year 1905 as against

* An address before the Trans-Mississippi Commercial Congress, Kansas City, Missouri, Tuesday, November 20, 1906, specially revised by Mr Root for publication in the NATIONAL GEOGRAPHIC MAGAZINE.

$1,117,513,071 of imports, and by $1,743,864,500 exports in the year 1906 as against $1,226,563,843 of imports. Our first steps in the new field indeed are somewhat clumsy and unskilled. In our own vast country, with oceans on either side, we have had too little contact with foreign peoples readily to understand their customs or learn their languages; yet no one can doubt that we shall learn and shall understand and shall do our business abroad as we have done it at home with force and efficiency.

A NEWLY AWAKENED CONTINENT TO THE SOUTH OF US

Coincident with this change in the United States the progress of political development has been carrying the neighboring continent of South America out of the stage of militarism into the stage of industrialism. Throughout the greater part of that vast continent revolutions have ceased to be looked upon with favor or submitted to with indifference; the revolutionary general and the dictator are no longer the objects of admiration and imitation; civic virtues command the highest respect; the people point with satisfaction and pride to the stability of their governments, to the safety of property and the certainty of justice; nearly everywhere the people are eager for foreign capital to develop their natural resources and for foreign immigration to occupy their vacant land. Immediately before us, at exactly the right time, just as we are ready for it, great opportunities for peaceful commercial and industrial expansion to the south are presented.

Other investing nations are already in the field—England, France, Germany, Italy, Spain; but the field is so vast, the new demands are so great, the progress so rapid, that what other nations have done up to this time is but a slight advance in the race for the grand total. The opportunities are so large that figures fail to convey them. The area of this newly awakened continent is 7,502,848 square miles, more than two and one-half times as large as the United States without Alaska and more than double the United States including Alaska. A large part of this area lies within the temperate zone, with an equable and invigorating climate, free from extremes of either heat or cold. Farther north in the tropics are enormous expanses of high tablelands stretching from the Atlantic to the foothills of the Andes, and lifted far above the tropical heats; the fertile valleys of the western Cordilleras are cooled by perpetual snows even under the Equator; vast forests grow untouched from a soil of incredible richness. The plains of Argentina, the great uplands of Brazil; the mountain valleys of Chile, Peru, Equador, Bolivia, and Colombia are suited to the habitation of any race, however far to the north its origin may have been; hundreds of millions of men can find healthful homes and abundant sustenance in this great territory.

The population in 1900 was only 42,461,381, less than six to the square mile. The density of population was less than one-eighth of that in the State of Missouri, less than one-sixtieth of that in the State of Massachusetts, less than one-seventieth of that in England, less than one per cent of that in Belgium.

With this sparse population the production of wealth is already enormous. The latest trade statistics show exports from South America to foreign countries of $745,530,000, and imports of $499,858,600. Of the five hundred millions of goods that South America buys we sell them but $63,246,525, or 12.6 per cent. Of the seven hundred and forty-five millions that South America sells we buy $152,092,000, or 20.4 per cent, nearly two and a half times as much as we sell.

Their production is increasing by leaps and bounds. In eleven years the exports of Chile have increased forty-five per cent from $54,030,000, in 1894, to $78,840,000, in 1905. In eight years the exports of Peru have increased one hundred per cent from $13,899,000, in 1897, to $28,758,000, in 1905. In ten years the exports of Brazil have increased sixty-six

per cent from $134,062,000, in 1894, to $223,101,000, in 1905. In ten years the exports of Argentina have increased one hundred and sixty-eight per cent from $115,868,000, in 1895, to $311,544,000, in 1905.

This is only the beginning; the coffee and rubber of Brazil, the wheat and beef and hides of Argentina and Uraguay, the copper and nitrates of Chile, the copper and tin of Bolivia, the silver and gold and cotton and sugar of Peru, are but samples of what the soil and mines of that wonderful continent are capable of yielding. Ninety-seven per cent of the territory of South America is occupied by ten independent republics living under constitutions substantially copied or adapted from our own. Under the new conditions of tranquillity and security which prevail in most of them, their eager invitation to immigrants from the old world will not long pass unheeded.

ARGENTINE RECEIVES 200,000 IMMIGRANTS ANNUALLY

The pressure of population abroad will inevitably turn its streams of life and labor towards those fertile fields and valleys; the streams have already begun to flow; more than two hundred thousand immigrants entered the Argentine Republic last year; they are coming this year at the rate of over three hundred thousand. Many thousands of Germans have already settled in southern Brazil. They are most welcome in Brazil; they are good and useful citizens there as they are here; I hope that many more will come to Brazil and every other South American country, and add their vigorous industry and good citizenship to the upbuilding of their adopted home.

With the increase of population in such a field, under free institutions, with the fruits of labor and the rewards of enterprise secure, the production of wealth and the increase of purchasing power will afford a market for the commerce of the world worthy to rank even with the markets of the Orient as the goal of business enterprise.

SOUTH AMERICANS ARE COMPLEMENTARY TO US

The material resources of South America are in some important respects complementary to our own; that continent is weakest where North America is strongest as a field for manufactures; it has comparatively little coal and iron.

In many respects the people of the two continents are complementary to each other: the South American is polite, refined, cultivated, fond of literature and of expression and of the graces and charms of life, while the North American is strenuous, intense, utilitarian. Where we accumulate, they spend. While we have less of the cheerful philosophy which finds sources of happiness in the existing conditions of life, they have less of the inventive faculty which strives continually to increase the productive power of man, and lower the cost of manufacture. The chief merits of the peoples of the two continents are different; their chief defects are different. Mutual intercourse and knowledge cannot fail to greatly benefit both; each can learn from the other; each can teach much to the other, and each can contribute greatly to the development and prosperity of the other. A large part of their products finds no domestic competition here; a large part of our products will find no domestic competition there. The typical conditions exist for that kind of trade which is profitable, honorable and beneficial to both parties.

The relations between the United States and South America have been chiefly political rather than commercial or personal. In the early days of the South American struggle for independence, the eloquence of Henry Clay awakened in the American people a generous sympathy for the patriots of the South as for brethren struggling in the common cause of liberty. The clear-eyed, judicious diplomacy of Richard Rush, the American Minister at the Court of St. James, effected a complete understanding with Great Britain for concurrent action

in opposition to the designs of the Holy Alliance, already contemplating the partition of the Southern Continent among the great powers of continental Europe. The famous declaration of Monroe arrayed the organized and rapidly increasing power of the United States as an obstacle to European interference and made it forever plain that the cost of European aggression would be greater than any advantage which could be won even by successful aggression.

THE MONROE DOCTRINE AS SOUND TODAY AS 80 YEARS AGO

That great declaration was not the chance expression of the opinion or the feeling of the moment; it crystallized the sentiment for human liberty and human rights which has saved American idealism from the demoralization of narrow selfishness, and has given to American democracy its true world power in the virile potency of a great example. It responded to the instinct of self-preservation in an intensely practical people. It was the result of conference with Jefferson and Madison and John Quincy Adams and John C. Calhoun and William Wirt—a combination of political wisdom, experience, and skill not easily surpassed. The particular circumstances which led to the declaration no longer exist; no Holy Alliance now threatens to partition South America; no European colonization of the west coast threatens to exclude us from the Pacific. But those conditions were merely the occasion for the declaration of a principle of action.

Other occasions for the application of the principle have arisen since; it needs no prophetic vision to see that other occasions for its application may arise hereafter. The principle declared by Monroe is as wise an expression of sound political judgment today, as truthful a representation of the sentiments and instincts of the American people today, as living in its force as an effective rule of conduct whenever occasion shall arise, as it was on the 2d of December, 1823.

These great political services to South American independence, however, did not and could not in the nature of things create any relation between the people of South America and the people of the United States except a relation of political sympathy.

THE NEW ERA OF AMERICAN RELATIONS

Twenty-five years ago Mr Blaine, sanguine, resourceful, and gifted with that imagination which enlarges the historian's understanding of the past into the statesman's comprehension of the future, undertook to inaugurate a new era of American relations which should supplement political sympathy by personal acquaintance, by the intercourse of expanding trade, and by mutual helpfulness. As Secretary of State under President Arthur, he invited the American nations to a conference to be held on the 24th of November, 1882, for the purpose of considering and discussing the subject of preventing war between the nations of America. That invitation, abandoned by Mr Frelinghuysen, was renewed under Mr Cleveland, and on the 2d of October, 1889, Mr Blaine, again Secretary of State under President Harrison, had the singular good fortune to execute his former design and to open the sessions of the first American conference at Washington. In an address of wisdom and lofty spirit, which should ever give honor to his memory, he described the assembly as:

"An honorable, peaceful conference of seventeen independent American powers, in which all shall meet together on terms of absolute equality; a conference in which there can be no attempt to coerce a single delegate against his own conception of the interests of his nation; a conference which will permit no secret understanding on any subject, but will frankly publish to the world all its conclusions; a conference which will tolerate no spirit of conquest, but will aim to cultivate an American sympathy as broad as both continents; a conference which will form no selfish alliance against the older nations from which we are proud to claim

inheritance—a conference, in fine, which will seek nothing, propose nothing, endure nothing that is not, in the general sense of all the delegates, timely, wise and peaceful."

The policy which Blaine inaugurated has been continued; the Congress of the United States has approved it; subsequent Presidents have followed it. The first conference at Washington has been succeeded by a second conference in Mexico, and now by a third conference in Rio de Janeiro; and it is to be followed in years to come by further successive assemblies in which the representatives of all American States shall acquire better knowledge and more perfect understanding and be drawn together by the recognition of common interests and the kindly consideration and discussion of measures for mutual benefit.

BOTH NORTH AND SOUTH AMERICA HAVE GROWN UP TO BLAINE'S POLICY

Nevertheless, Mr Blaine was in advance of his time. In 1881 and 1889 neither had the United States reached a point where it could turn its energies away from its own internal development and direct them outward towards the development of foreign enterprises and foreign trade, nor had the South American countries reached the stage of stability in government and security for property necessary to their industrial development.

Now, however, the time has come; both North and South America have grown up to Blaine's policy; the production, the trade, the capital, the enterprise of the United States have before them the opportunity to follow, and they are free to follow, the pathway marked out by the far-sighted statesmanship of Blaine for the growth of America, North and South, in the peaceful prosperity of a mighty commerce.

To utilize this opportunity certain practical things must be done. For the most part these things must be done by a multitude of individual efforts; they cannot be done by government. Government may help to furnish facilities for the doing of them, but the facilities will be useless unless used by individuals; they cannot be done by resolutions of this or any other commercial body; resolutions are useless unless they stir individual business men to action in their own business affairs. The things needed have been fully and specifically set forth in many reports of efficient consuls and of highly competent agents of the Department of Commerce and Labor, and they have been described in countless newspapers and magazine articles; but all these things are worthless unless they are followed by individual action. I will indicate some of the matters to which every producer and merchant who desires South American trade should pay attention:

SOME ESSENTIALS OF SUCCESS IN THE SOUTH AMERICAN FIELD

1. He should learn what the South Americans want and conform his product to their wants. If they think they need heavy castings, he should give them heavy castings and not expect them to buy light ones because he thinks they are better. If they want coarse cottons, he should give them coarse cottons and not expect them to buy fine cottons. It may not pay today, but it will pay tomorrow. The tendency to standardize articles of manufacture may reduce the cost and promote convenience, but if the consumers on the River Plate demand a different standard from the consumers on the Mississippi, you must have two standards or lose one market.

2. Both for the purpose of learning what the South American people want and of securing their attention to your goods, you must have agents who speak the Spanish or Portuguese language. For this there are two reasons; one is that people can seldom really get at each other's minds through an interpreter, and the other is that nine times out of ten it is only through knowing the Spanish or Portuguese language that a North American comes to appreciate the admirable and attractive personal qualities of

the South American, and is thus able to establish that kindly and agreeable personal relation which is so potent in leading to business relations.

3. The American producer should arrange to conform his credit system to that prevailing in the country where he wishes to sell goods. There is no more money lost upon commercial credits in South America than there is in North America; but business men there have their own ways of doing business; they have to adapt the credits they receive to the credits they give. It is often inconvenient, disagreeable, and sometimes impossible for them to conform to our ways, and the requirement that they should do so is a serious obstacle to trade.

To understand credits it is, of course, necessary to know something about the character, trustworthiness, and commercial standing of the purchaser, and the American producer or merchant who would sell goods in South America must have some means of knowledge upon this subject. This leads naturally to the next observation I have to make.

4. The establishment of banks should be brought about. The Americans already engaged in South American trade could well afford to subscribe the capital and establish an American bank in each of the principal cities of South America. This is, first because nothing but very bad management could prevent such a bank from making money; capital is much needed in those cities, and six, eight and ten per cent can be obtained for money upon just as safe security as can be had in Kansas City, St Louis, or New York. It is also because the American bank would furnish a source of information as to the standing of the South American purchasers to whom credit may be extended, and because American banks would relieve American business in South America from the disadvantage which now exists of making all its financial transactions through Europe instead of directly with the United States. It is unfortunately true that among hundreds of thousands of possible customers the United States now stands in a position of assumed financial and business inferiority to the countries through whose banking houses all its business has to be done.

5. The American merchant should himself acquire, if he has not already done so, and should impress upon all his agents, that respect for the South American to which he is justly entitled and which is the essential requisite to respect from the South American. We are different in many ways as to character and methods. In dealing with all foreign people it is important to avoid the narrow and uninstructed prejudice which assumes that difference from ourselves denotes inferiority. There is nothing that we resent so quickly as an assumption of superiority or evidence of condescension in foreigners; there is nothing that the South Americans resent so quickly. The South Americans are our superiors in some respects; we are their superiors in other respects. We should show to them what is best in us and see what is best in them. Every agent of an American producer or merchant should be instructed that courtesy, politeness, kindly consideration are essential requisites for success in the South American trade.

6. The investment of American capital in South America under the direction of American experts should be promoted, not merely upon simple investment grounds, but as a means of creating and enlarging trade. For simple investment purposes the opportunities are innumerable. Good business judgment and good business management will be necessary there, of course, as they are necessary here; but given these, I believe that there is a vast number of enterprises awaiting capital in the more advanced countries of South America, capable of yielding great profits, and in which the property and the profits will be as safe as in the United States or Canada.

A good many such enterprises are already begun. I have found a graduate of the Massachusetts Institute of Tech-

nology, a graduate of the Columbia School of Mines and a graduate of Colonel Roosevelt's Rough Riders smelting copper close under the snow line of the Andes; I have ridden in an American car upon an American electric road, built by a New York engineer, in the heart of the coffee region of Brazil, and I have seen the waters of that river, along which Pizarro established his line of communication in the conquest of Peru, harnessed to American machinery to make light and power for the city of Lima. Every such point is the nucleus of American trade—the source of orders for American goods.

7. It is absolutely essential that the means of communication between the two countries should be improved and increased.

This underlies all other considerations and it applies both to the mail, the passenger and the freight services. Between all the principal South American ports and England, Germany, France, Spain, Italy lines of swift and commodious steamers ply regularly. There are five subsidized first-class mail and passenger lines between Buenos Aires and Europe; there is no such line between Buenos Aires and the United States. Within the past two years the German, the English and the Italian lines have been replacing their old steamers with new and swifter steamers of modern construction, accommodation and capacity.

In the year ending June 30, 1905, there entered the port of Rio de Janeiro steamers and sailing vessels flying the flag of Austria-Hungary 120, of Norway 142, of Italy 165, of Argentina 264, of France 349, of Germany 657, of Great Britain, 1,785, of the United States no steamers and seven sailing vessels, two of which were in distress!

An English firm runs a small steamer monthly between New York and Rio de Janeiro; the Panama Railroad Company runs steamers between New York and the Isthmus of Panama; the Brazilians are starting for themselves a line between Rio and New York; there are two or three foreign concerns running slow cargo boats, and there are some foreign tramp steamers. That is the sum total of American communications with South America beyond the Caribbean Sea.

NOT ONE AMERICAN STEAMSHIP RUNS TO ANY SOUTH AMERICAN PORT BEYOND THE CARIBBEAN

During the past summer I entered the ports of Para, Pernambuco, Bahia, Rio de Janeiro, Santos, Montevideo, Buenos Aires, Bahia Blanca, Punta Arenas, Lota, Valparaiso, Coquimbo, Tocopilla, Callao and Carthagena—all of the great ports and a large proportion of the secondary ports of the Southern Continent. I saw only one ship, besides the cruiser that carried me, flying the American flag.

The mails between South America and Europe are swift, regular and certain; between South America and the United States they are slow, irregular and uncertain. Six weeks is not an uncommon time for a letter to take between Buenos Aires or Valparaiso and New York. The merchant who wishes to order American goods cannot know when his order will be received or when it will be filled.

The freight charges between the South American cities and American cities are generally and substantially higher than between the same cities and Europe; at many points the deliveries of freight are uncertain and its condition upon arrival doubtful.

The passenger accommodations are such as to make a journey to the United States a trial to be endured and a journey to Europe a pleasure to be enjoyed. The best way to travel between the United States and both the southwest coast and the east coast of South America is to go by way of Europe, crossing the Atlantic twice. It is impossible that trade should prosper or intercourse increase or mutual knowledge grow to any great degree under such circumstances. The communication is worse now than it was twenty-five years ago. So long as it is left in the hands of our foreign competi-

tors in business we cannot reasonably look for any improvement. It is only reasonable to expect that European steamship lines shall be so managed as to promote European trade in South America rather than to promote the trade of the United States in South America.

This woeful deficiency in the means to carry on and enlarge our South American trade is but a part of the general decline and feebleness of the American merchant marine, which has reduced us from carrying over ninety per cent of our export trade in our own ships to the carriage of nine per cent of that trade in our own ships and dependence upon foreign shipowners for the carriage of ninety-one per cent. The true remedy and the only remedy is the establishment of American lines of steamships between the United States and the great ports of South America adequate to render fully as good service as is now afforded by the European lines between those ports and Europe. The substantial underlying fact was well stated in the resolution of this Trans-Mississippi Congress three years ago:

"That every ship is a missionary of trade; that steamship lines work for their own countries just as railroad lines work for their terminal points, and that it is as absurd for the United States to depend upon foreign ships to distribute its products as it would be for a department store to depend upon wagons of a competing house to deliver its goods."

How can this defect be remedied? The answer to this question must be found by ascertaining the cause of the decline of our merchant marine. Why is it that Americans have substantially retired from the foreign transport service? We are a nation of maritime traditions and facility; we are a nation of constructive capacity, competent to build ships; we are eminent, if not preëminent, in the construction of machinery; we have abundant capital seeking investment; we have courage and enterprise, shrinking from no competition in any field which we choose to enter. Why, then, have we retired from this field, in which we were once conspicuously successful?

I think the answer is twofold.

THE AMERICAN SAILORS RIGHTFULLY DEMAND THE AMERICAN SCALE OF LIVING

1. The higher wages and the greater cost of maintenance of American officers and crews make it impossible to compete on equal terms with foreign ships. The scale of living and the scale of pay of American sailors are fixed by the standard of wages and of living in the United States, and those are maintained at a high level by the protective tariff. The moment the American passes beyond the limits of his country and engages in ocean transportation he comes into competition with the lower foreign scale of wages and of living. Mr Joseph L. Bristow in his report upon trade conditions affecting the Panama Railroad, dated June 14, 1905, gives in detail the cost of operating an American steamship with a tonnage of approximately thirty-five hundred tons as compared with the cost of operating a specified German steamship of the same tonnage, and the differences aggregate $15,315 per annum greater cost for the American steamship than for the German, that is $4.37 per ton. He gives also in detail the cost of maintaining another American steamship with a tonnage of approximately twenty-five hundred tons as compared with the cost of operating a specified British steamship of the same tonnage, and the differences aggregate $18,289.68 per annum greater cost for the American steamship than for the British, that is $7.31 per ton. It is manifest that if the German steamship were content with a profit of less than $15,000 per annum, and the British with a profit of less than $18,000 per annum, the American ships would have to go out of business.

2. The principal maritime nations of the world, anxious to develop their trade, to promote their shipbuilding industry, to have at hand transports and auxiliary cruisers in case of war, are fostering their

steamship lines by the payment of subsidies. England is paying to her steamship lines between six and seven million dollars a year; it is estimated that since 1840 she has paid to them between two hundred and fifty and three hundred millions. The enormous development of her commerce, her preponderant share of the carrying trade of the world, and her shipyards crowded with construction orders from every part of the earth, indicate the success of her policy. France is paying about eight million dollars a year; Italy and Japan, between three and four million each; Germany, upon the initiative of Bismarck, is building up her trade with wonderful rapidity by heavy subventions to her steamship lines and by giving special differential rates of carriage over her railroads for merchandise shipped by those lines. Spain, Norway, Austria-Hungary, Canada all subsidize their own lines. It is estimated that about $28,000,000 a year are paid by our commercial competitors to their steamship lines.

Against these advantages to his competitor the American ship owner has to contend; and it is manifest that the subsidized ship can afford to carry freight at cost for a long enough period to drive him out of business.

We are living in a world not of natural competition, but of subsidized competition. State aid to steamship lines is as much a part of the commercial system of our day as state employment of consuls to promote business.

IT IS NOT A FAIR FIGHT

It will be observed that both of these disadvantages under which the American ship owner labors are artificial; they are created by governmental action, one by our own government in raising the standard of wages and living, by the protective tariff, the other by foreign governments in paying subsidies to their ships for the promotion of their own trade. For the American ship owner it is not a contest of intelligence, skill, industry and thrift against similar qualities in his competitor; it is a contest against his competitors and his competitors' governments and his own government also.

Plainly these disadvantages created by governmental action can be neutralized only by governmental action, and should be neutralized by such action.

What action ought our Government to take for the accomplishment of this just purpose? Three kinds of action have been advocated.

1. A law providing for free ships—that is, permitting Americans to buy ships in other countries and bring them under the American flag. Plainly this would not at all meet the difficulties which I have described. The only thing it would accomplish would be to overcome the excess in cost of building a ship in an American shipyard over the cost of building it in a foreign shipyard; but since all the materials which enter into an American ship are entirely relieved of duty, the difference in cost of construction is so slight as to be practically a negligible quantity and to afford no substantial obstacle to the revival of American shipping. The expedient of free ships, therefore, would be merely to sacrifice our American shipbuilding industry, which ought to be revived and enlarged with American shipping, and to sacrifice it without receiving any substantial benefit. It is to be observed that Germany, France, and Italy all have attempted to build up their own shipping by adopting the policy of free ships, have failed in the experiment, have abandoned it, and have adopted in its place the policy of subsidy.

2. It has been proposed to establish a discriminating tariff duty in favor of goods imported in American ships, that is to say, to impose higher duties upon goods imported in foreign ships than are imposed on goods imported in American ships. We tried that once many years ago and have abandoned it. In its place we have entered into treaties of commerce and navigation with the principal countries of the world expressly agreeing that no such discrimination shall be made between their vessels and ours. To sweep

away all those treaties and enter upon a war of commercial retaliation and reprisal for the sake of accomplishing indirectly what can be done directly should not be seriously considered.

3. There remains the third and obvious method: To neutralize the artificial disadvantages imposed upon American shipping through the action of our own government and foreign governments by an equivalent advantage in the form of a subsidy or subvention. In my opinion this is what should be done; it is the sensible and fair thing to do. It is what must be done if we would have a revival of our shipping and the desired development of our foreign trade. We cannot repeal the protective tariff; no political party dreams of repealing it; we do not wish to lower the standard of American living or American wages.

We should give back to the ship owner what we take away from him for the purpose of maintaining that standard, and unless we do give it back, we shall continue to go without ships.

How can the expenditure of public money for the improvement of rivers and harbors to promote trade be justified upon any grounds which do not also sustain this proposal? Would any one reverse the policy that granted aid to the Pacific railroads, the pioneers of our enormous internal commerce, the agencies that built up the great traffic which has enabled half a dozen other roads to be built in later years without assistance? Such subventions would not be gifts. They would be at once compensation for injuries inflicted upon American shipping by American laws and the consideration for benefits received by the whole American people—not the shippers or the shipbuilders or the sailors alone, but by every manufacturer, every miner, every farmer, every merchant whose prosperity depends upon a market for his products.

The provision for such just compensation should be carefully shaped and directed so that it will go to individual advantage only so far as the individual is enabled by it to earn a reasonable profit by building up the business of the country.

A MOST IMPORTANT MEASURE

A bill is now pending in Congress which contains such provisions; it has passed the Senate and is now before the House Committee on Merchant Marine and Fisheries; it is known as Senate Bill No. 529, Fifty-ninth Congress, first session. It provides specifically that the Postmaster General may pay to American steamships, of specified rates of speed, carrying mails upon a regular service, compensation not to exceed the following amounts: For a line from an Atlantic port to Brazil, monthly, $150,000 a year; for a line from an Atlantic port to Uruguay and Argentina, monthly, $87,500 a year; for a line from a Gulf port to Brazil, monthly, $137,500 a year; for a line from each of two Gulf ports and from New Orleans to Central America and the Isthmus of Panama, weekly, $75,000 a year; for a line from a Gulf port to Mexico, weekly, $50,000 a year; for a line from a Pacific Coast port to Mexico, Central America and the Isthmus of Panama, fortnightly, $120,000 a year. For these six regular lines a total of $720,000. The payments provided are no more than enough to give the American ships a fair living chance in the competition.

There are other wise and reasonable provisions in the bill relating to trade with the Orient, to tramp steamers and to a naval reserve, but I am now concerned wth the provisions for trade to the South. The hope of such a trade lies chiefly in the passage of that bill.

Postmaster General Cortelyou, in his report for 1905, said:

"Congress has authorized the Postmaster General, by the act of 1891, to contract with the owners of American steamships for ocean mail service and has realized the impracticability of commanding suitable steamships in the interest of the postal service alone by requiring that such steamers shall be of a size, class, and equipment which will promote com-

merce and become available as auxiliary cruisers of the navy in case of need. The compensation allowed to such steamers is found to be wholly inadequate to secure the proposals contemplated; hence advertisements from time to time have failed to develop any bids for much-needed service. This is especially true in regard to several of the countries of South America with which we have cordial relations and which, for manifest reasons, should have direct mail connections with us. I refer to Brazil and countries south of it. Complaints of serious delay to mails for these countries have become frequent and emphatic, leading to the suggestion on the part of certain officials of the government that for the present, and until more satisfactory direct communication can be established, important mails should be dispatched to South America by way of European ports and on European steamers, which would not only involve the United States in the payment of double transit rates to a foreign county for the dispatch of its mails to countries of our own hemisphere, but might seriously embarrass the government in the exchange of important official and diplomatic correspondence.

"The fact that the government claims exclusive control of the transmission of letter mail throughout its own territory would seem to imply that it should secure and maintain the exclusive jurisdiction, when necessary, of its mails on the high seas. The unprecedented expansion of trade and foreign commerce justifies prompt consideration of an adequate foreign mail service."

THE U.S. GOVERNMENT NETS 100 PER CENT PROFIT ON ITS FOREIGN MAIL

It is difficult to believe, but it is true, that out of this faulty ocean mail service the government of the United States is making a large profit. The actual cost to the government last year of the ocean mail service to foreign countries other than Canada and Mexico was $2,965,624.21, while the proceeds realized by the government from postage between the United States and foreign countries other than Canada and Mexico was $6,008,807.53, leaving the profit to the United States of $3,043,183.32; that is to say, under existing law the government of the United States, having assumed the monopoly of carrying the mails for the people of the country, is making a profit of three million dollars per annum by rendering cheap and inefficient service. Every dollar of that three millions is made at the expense of the commerce of the United States. What can be plainer than that the government ought to expend at least the profits that it gets from the ocean mail service in making the ocean mail service efficient. One-quarter of those profits would establish all these lines which I have described between the United States and South and Central America and give us, besides a good mail service, enlarged markets for the producers and merchants of the United State who pay the postage from which the profits come.*

In his last message to Congress, President Roosevelt said:

"To the spread of our trade in peace and the defense of our flag in war a great and prosperous merchant marine is indispensable. We should have ships of our own and seamen of our own to convey our goods to neutral markets, and in case of need to reënforce our battle line. It cannot but be a source of regret and uneasiness to us that the lines of communication with our sister republics of South America should be chiefly under foreign control. It is not a good thing that American merchants and manufacturers should have to send their goods and letters to South America via Europe if they wish security and dispatch. Even on the Pacific, where our ships have held their own better than on the Atlantic, our merchant flag is now threatened through the liberal aid bestowed by other govern-

* There would be some modification of these figures if the cost of getting the mails to and from the exchange offices were charged against the account; but this is not separable from the general domestic cost and would not materially change the result.

ments on their own steam lines. I ask your earnest consideration of the report with which the Merchant Marine Commission has followed its long and careful inquiry."

The bill now pending in the House is a bill framed upon the report of that Merchant Marine Commission. The question whether it shall become a law depends upon your Representatives in the House. You have the judgment of the Postmaster General, you have the judgment of the Senate, you have the judgment of the President; if you agree with these judgments and wish the bill which embodies them to become a law, say so to your Representatives. Say it to them individually and directly, for it is your right to advise them and it will be their pleasure to hear from you what legislation the interests of their constituents demand.

The great body of Congressmen are always sincerely desirous to meet the just wishes of their constituents and to do what is for the public interest; but in this great country they are continually assailed by innumerable expressions of private opinion and by innumerable demands for the expenditure of public money; they come to discriminate very clearly between private opinion and public opinion and between real public opinion and the manufactured appearance of public opinion; they know that when there is a real demand for any kind of legislation it will make itself known to them through a multitude of individual voices. Resolutions of commercial bodies frequently indicate nothing except that the proposer of the resolution has a positive opinion and that no one else has interest enough in the subject to oppose it. Such resolutions by themselves, therefore, have comparatively little effect; they are effective only when the support of individual expressions shows that they really represent a genuine and general opinion.

It is for you and the business men all over the country whom you represent to show to the Representatives in Congress that the producing and commercial interests of the country really desire a practical measure to enlarge the markets and increase the foreign trade of the United States by enabling American shipping to overcome the disadvantages imposed upon it by foreign governments for the benefit of their trade and by our government for the benefit of our home industry.

FIGHTING THE POLAR ICE

IN "Fighting the Polar Ice," just published by Messrs Doubleday, Page & Co., Mr Fiala gives a graphic narrative of the Ziegler Polar Expedition of 1903-1905, of which he was the commander. The scientific work of this expedition, it will be remembered, was under the direction of the National Geographic Society. The expedition failed in its object of getting to the Pole, reaching only 82°, owing to wide open leads in the ice, succeeded by immense pressure ridges; but their two years' stay in the Far North was amply repaid by detailed explorations of previously uncharted portions of the Franz Josef Archipelago and by a series of magnetic and meteorological observations by Messrs W. J. Peters and R. W. Porter, which from their exactness and continuity have proved immensely valuable. The Scientific Report is in press and will be published shortly by the National Geographic Society.

The expedition left Norway early in July, 1903, but owing to the great amount of ice encountered failed to reach Teplitz Bay, in Franz Josef Land, before the end of August.

As a result, they had not time before the darkness set in to discharge the supplies, and were therefore compelled to

"WE CROSSED THE ARCTIC CIRCLE, AND ALL MEMBERS OF THE EXPEDITION WHO HAD NOT CROSSED THE PARALLEL BEFORE, WERE SEIZED BY THEIR COMRADES WHO HAD, AND INITIATED AS POLAR EXPLORERS BY BEING THROWN OVERBOARD WHILE THE STEAMER WAS IN MOTION, THEIR SAFETY FIRST INSURED BY A LONG LINE MADE FAST AROUND THEIR WAISTS."

This and the following photographs are copyrighted by Anthony Fiala.

keep their ship in an open roadstead, where she was finally crushed and sunk by the ice with more than half the provisions and coal. What they had taken ashore, however, was sufficient for one year.

The failure of the relief ship to appear in 1904 would have seriously embarrassed the party if it had not been for the abundant stores cached at Cape Flora by the Duke of Abruzzi and a vein of coal found by Assistant Engineer Vedoe 600 feet up the talus. The coal burned freely. Twenty tons of it were mined out of the frozen clay and carried down the steep talus on the backs of the men.

Mr Fiala writes very entertainingly his power of description being exceedingly realistic. Particularly vivid are the chapters describing the grinding of the ship by the immense fields of ice which finally engulfed her; and the march in the blackness of an arctic night from Camp Ziegler to Camp Abruzzi, a distance of 200 miles. The lowest temperature recorded was 60.2 below zero (Fahr.), on January 5, 1905.

The volume is magnificently illustrated from photographs by Mr Fiala, the panoramic pictures giving us a better idea of the difficulties of dragging sledges over the polar ice than any pictures heretofore published.

"It is a curious fact that when one dog has antagonized the others the only way to save him from destruction later on is to chain him. Then the other dogs let him alone. Unfortunately for us, the dogs that seemed to incur the enmity of their fellows were the large, strong animals—the bullies and fighters. There seemed to be a degree of justice in their judgments. From close observation, I found that the dogs generally forgave a bite on the head or body, while an attack

HAULING THE CARCASS OF A POLAR BEAR ABOARD THE SHIP

on the legs seemed to be considered foul play and must be paid for by the life of the offending canine—the whole pack uniting in his execution.

"The one important point in which our equipment differed radically from that prepared for other attempts over the polar ice was in the use of ponies. These tough little animals are accustomed to the very lowest temperatures experienced in the steppes of Siberia, some parts of which are considered the coldest places of the earth. They are also accustomed to forcing their way through deep snows and across frozen rivers whose shores are lined with broken ice and deep drifts. They had been used first by Jackson, who believed them superior to dog teams and used them in preference to dogs on his trips of exploration and survey through the Franz Josef Archipelago.

"On smooth ice the dogs traveled faster than their rivals, but as soon as they struck rough going, the ponies outdistanced the dogs easily, at the same time dragging heavier loads. The men driving the dog teams were tired out at the end of a day's march by the constant exertion in helping the dogs pull their loads up grades and over ice-blocks, but it was seldom that the ponies required assistance.

"Over 120 polar bears were killed during our two years' stay in the Franz Josef Archipelago. Scurvy was unknown and the general health of the party was good.

"During the summer our party secured seventeen bears, and we luxuriated in bear steaks fried in butter. Most of the men enjoyed the meat, which was not unlike beef when prepared carefully, by cutting away all fat before frying. The fat gave the meat a rancid taste.

"In the nesting time of the gulls and loons, several of the sailors went up the talus daily, dragging with them a long ladder that they had constructed and, at the risk of their lives, clambered up the precipitous side of the great rock and robbed the nests. Many of the eggs were fresh, and when fried with the ham we had found in the Duke's cache gave us a breakfast not be despised.

"Eight brant and several hundred loons were shot and added to our larder

"LOUISE"

and sixteen great walruses and about the same number of seals. Walrus liver was considered a delicacy, but the meat proper was rather tough and made one think he was dining on automobile tires."

The party also shot a number of ptarmigan, which is interesting as the first recorded appearance of these birds in the archipelago. Mr Fiala pays a well-deserved tribute to Mr W. S. Champ, the leader of the relief expedition of 1905.

This volume is the fourth of the Geographical Library published by Doubleday, Page & Co. The fifth, "Nearest the Pole," by Commander Robert E. Peary, will appear in the early spring.

GEOGRAPHIC LITERATURE

Flashlights in the Jungle: A record of hunting adventures and of studies in wild life in equatorial East Africa. By C. G. Schillings: translated by Frederick Whyte. Illustrated with 302 of the author's "untouched" photographs taken by day and night. New York: Doubleday, Page & Company. 1906. $3.80 *net.*

The most remarkable part of this very interesting book are the pictures which are snapshots at wild animals. Particularly wonderful are the flashlights of "lions killing an ox" (393) and of three full-grown lionesses (356), and still another of a lioness about to spring upon a donkey (378). There is also a remarkable series of flashlights of groups of zebra drinking at night (333, 337, 323) and a picture of a rhinoceros with its young (231), and two really wonderful pictures taken by daylight at fifteen paces of rhinoceroses bathing (205, 206). There is another series of giraffes stalking through the forest, taken by daylight (307, 321). The book is in fact full of rare and unique pictures of all sorts of animals and is worth many times the price for the pictures alone.

Herr Schillings' experiences show that photographing was often dangerous work. The following description of photographing rhinoceroses is quoted: "Accompanied now by only two of my bearers and two Masai, I succeeded in approaching warily within 120 yards of them. I had taken several pictures successfully with my telephoto-lens, when suddenly for some reason the animals stood up quickly, both together, as is their wont. Almost simultaneously the farther of the two, an old cow, began moving the front part of the body to and fro, and then, followed by the bull with head high in the air, came straight for me, full gallop. I had instinctively felt what would happen, and in a moment my rifle was in my hands and my camera passed to my bearers. I fired six shots and succeeded in bringing down both animals twice as they rushed toward me. Great furrows in the sand of the velt showed where they fell.

"My final shot I fired in the absolute certainty that my last hour had come. It hit the cow in the nape of the neck, and at the same moment I sprang to the right, to the other side of the brier bush. With astounding agility the rhinoceroses followed me, and half way round the bush I found myself between the two animals. It seems incredible, now that I tell the tale in

CROSSING A LEAD IN THE CHANNEL ICE—HAULING A TEAM OF DOGS THROUGH THE WATER

THE PONY COLUMN CROSSING RUDOLF ISLAND GLACIER

"WE SEEMED TO BE IN AN IMMENSE RIVER OF BROKEN ICE"

cold blood, but in that same instant my shots took effect mortally and both rhinoceroses collapsed."

Dr Schillings' pictures will constantly enhance in value, for the time is not distant when the huge beasts he so vividly describes will be as rare as the American buffalo.

E. M. G.

The Uncompahgre Valley and the Gunnison Tunnel. By Barton W. Marsh. Pp. 151. 5¼ by 8¼ inches. Illustrated. Montrose, Colo.: Marsh and Torrence. 1905.

The compilers of this volume state in their preface that their object is "to assist those who contemplate making a change of location, as well as for the distribution of accurate knowledge of this part of the country." Useful information is given about the situation and surroundings of the valley, resources and products of the land, present water supply, climate, towns and industries, educational advantages, and finally the advantages of irrigation by turning the waters of the Uncompahgre River into the valley by means of the Gunnison Tunnel.

NATIONAL GEOGRAPHIC SOCIETY

January 4—"German East Africa." By Dr Louis Livingstone Seaman, of New York. Illustrated.

January 18—"Camping Expeditions in the Canadian Rockies." By Mr Howard Du Bois.

January 25—"Bolivia—a Country Without a Debt." By the Bolivian Minister, Señor F. Calderon. Illustrated.

February 1—"The Rising Pacific Empire." By Hon. George C. Perkins, U. S. Senator from California.

February 8—"The Guianas." By Prof. Angelo Heilprin, of Yale University. Illustrated.

February 15—"Ten Years of Polar Work; or, What We Know and What We Want to Know." By Mr Herbert L. Bridgman, Secretary of the Peary Arctic Club. Illustrated.

February 19—"Two Thousand Miles in the Saddle through Colombia and Ecuador." By Hon. John Barrett, U. S. Minister to Colombia. Illustrated.

March 1—"Santo Domingo and Haiti." By Rear Admiral Chester, U. S. Navy. Illustrated.

March 15—"The Regeneration of Korea." By Mr George Kennan. Illustrated.

March 21—"Our Immigrants: Where They Come From, What They Are, and What They Do After They Get Here." By Hon. F. P. Sargent, Commissioner General of Immigration. Illustrated.

March 23—"Queer Methods of Travel in Curious Corners of the World." By Hon. O. P. Austin, Chief Bureau of Statistics. Illustrated.

March 29—"Mexico—the Treasure-house of the World." By Mr N. H. Darton, of the U. S. Geological Survey. Illustrated.

April 5—"A Popular Explanation of Earthquakes and Volcanoes." By Dr G. K. Gilbert, of the U. S. Geological Survey. Illustrated.

April 12—"Captain John Smith and Old Jamestown." By Mr W. W. Ellsworth, Secretary of the Century Co.

Announcements will be made later of addresses by Commander Robert E. Peary, U. S. Navy, who has recently attained "Farthest North," and by Dr F. A. Cook, of Brooklyn, who has accomplished the first ascent of Mount McKinley, the highest mountain in North America.

SCIENTIFIC MEETINGS

The meetings of this course will be held at the home of the Society, Hubbard Memorial Hall, Sixteenth and M streets, at 8 p. m., on the following dates:

January 11—Annual Meeting. "Aboriginal Agriculture in Guatemala." By Mr O. F. Cook, of the U. S. Department of Agriculture. Illustrated.

January 22—"The Coal Lands of the U. S. Public Domain." By Mr M. R. Campbell, of the U. S. Geological Survey. Illustrated.

February 9—"A Visit to Sumatra." By Mr George H. Peters, of the U. S. Naval Observatory. Illustrated.

February 18—"Reclaiming the Desert." By Mr. C. J. Blanchard, of the U. S. Reclamation Service. Illustrated. The Reclamation Service has a fund of $40,000,000, which is being invested in irrigation works.

February 22—"Reclaiming the Swamp Lands of the United States." By Mr H. M. Wilson, of the U. S. Geological Survey. Illustrated.

February 28—"Acclimatizing Fishes—or Transplanting Fishes from the Atlantic to the Pacific, and Vice Versa, etc." By Dr Hugh M. Smith, Deputy Commissioner, Bureau of Fisheries. Illustrated.

March 8—"Twenty Years in Beirut and Damascus; or, The Syria of Today." By Rev. F. E. Hoskins. Illustrated.

March 11—"The U. S. Forest Service." By Mr Gifford Pinchot, Forester. Illustrated. The Forest Service has charge of 114,606,058 acres of forest land, worth $400,000,000.

March 22—"Utilizing the Surface Waters of the United States for Power." By Mr H. A. Pressey, C. E. Illustrated.

April 6—"The South Sea Islanders." By Mr A. B. Alexander, of the U. S. Bureau of Fisheries. Illustrated.

April 15—"Photographs of Wild Game Taken by Themselves." By Hon. George Shiras, 3d. Illustrated.

April 19—"A Trip to Argentine and Paraguay." By Mr John W. Titcomb, of the U. S. Bureau of Fisheries. Illustrated.

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NATIONAL GEOGRAPHIC SOCIETY

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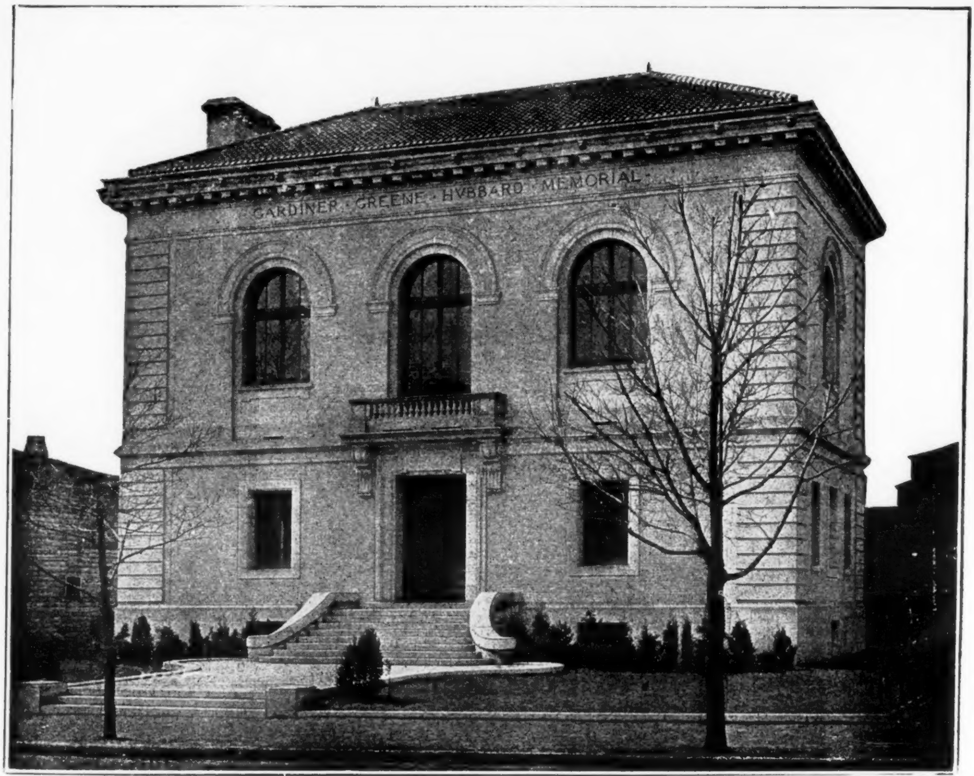

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